ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LX. No. 12. CHICAGO, SATURDAY, MARCH 23, 1912. ISSUED WEEKLY.

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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FAIR TREATMENT OF CUSTOMERS.

Much has been written and said regarding the going value of a public-utility business. While some doubt seems to exist as to just what this means and of how it should be estimated in monetary value, it cannot be denied that there are a number of intangible elements which go to make up the successful operation of any business. Among these is to be noted the cordial and friendly attitude of the public toward the utility company. Such an attitude does not exist in a great many cities and towns. In some cases this is due to a general feeling of opposition and resentment among the public toward all corporations, which is due largely to the iniquities which have been practiced by a certain few of them in the past, such as the notorious oil and tobacco trusts. In other cases the unfriendly attitude of the public is due to specific instances of treatment by the local corporation which have seemed to the customers to be unfair.

An example of the latter condition has been brought to our attention recently in the case of a town which formerly had two companies supplying electric power. The consolidation of these companies was recently effected, one company buying out the other and carrying on the entire business under one management. Of course, the purchaser was under obligations to fill the contracts of the submerged company, but in doing so it placed its own interpretation upon the latter's contracts.

A certain customer had a contract for a base rate up to a certain consumption of electric power and a reduced rate for the monthly consumption in excess of that amount. This wording was originally intended to cover energy consumption for both lighting and motor operation and the company making the contract had always so interpreted it. The new management, however, chose to interpret this contract so as to make electric power include only the energy used for motor operation, with the result that the customer was required to pay for his entire consumption at the maximum rate, since the lighting formed a large proportion of his bill. Naturally this customer felt that he had not had fair treatment and his neighbors took the same view. The result is a feeling of ill will toward this corporation among a large element of the population in the territory which it supplies. The income from this particular customer is no doubt greater than it would be under the original interpretation of the contract, and yet one result has been a diminution in the consumption by this particular customer and a tendency to discourage the introduction of any additional motors where

the same are not absolutely necessary, since he feels that he can never tell when his rate may be increased.

Such a condition of affairs always reacts in the long run against the company which follows such a practice. A reputation for fair dealing and generous treatment of customers and a desire to look out for the latter's interests is of far more value to any operating utility company than a slight increase in a customer's bill. Such practices are greatly to be deplored, since they create public sentiment against the elimination of competition in a business that is a natural monopoly and can be more efficiently managed and operated without competition. Managers of electric companies should make efforts to avoid such practices as are referred to.

CONCERNING LEADS FOR INDUCTION MOTORS.

One of the vexed questions with which electrical contractors have to contend is that of determining the proper sizes of feeders for supplying current to induction motors of the squirrel-cage type. As is well known, the magnitude of the current which a motor of this kind will take while being started is a rather indeterminate quantity, and this fact often causes the man installing such a machine to be in great doubt as to how to proceed in computing the necessary size of the leads to be used. In a few of the larger cities the departments of electrical inspection have endeavored to relieve the situation of its awkwardness by distributing among contractors tables specifying the sizes of leads which must be supplied for operating induction motors of the capacities more generally used in industrial practice; but it often happens that even then the patrons of the electrical service feel that the use of unnecessarily large conductors is demanded and are thus led to complain because of their high cost.

Engineers sometimes state that the starting current of a squirrel-cage motor may be four or five times its normal full-load running current. Such a statement as this, however, is by no means a complete indication of the heating effect of the current; for it does not include the duration of the peak current, and the heating effect depends, of course, both upon the strength of this current and upon its duration. At a convention of electrical inspectors not long ago, a lecturer showed an oscillogram of the starting current of an induction motor which indicated a maximum value of about four times the amperes required on full load and a duration of the maximum of a very small fraction of a second. This was a small motor, however, and the source of power supplied to it must certainly have been of a capacity many times that of the motor itself. If a five-horsepower motor, say, be thrown directly on a hundred-kilowatt alternator not already loaded, the starting current will usually be relatively quite heavy, but the motor will come up to speed very quickly; whereas, if the capacity of the motor be nearly equal to that of the source of power, the voltage of the former will generally drop so as to reduce the starting current greatly, and, because of this drop, the machine will require more time to get under way. It is to be noted in this connection, too, that however large the source of power, the strength of the peak current and its duration are always influenced by the percentage of the rated voltage of the motor that the starting compensator is connected up to give, where a compensator is used, as is generally the case on machines larger than five horsepower.

It may not be out of place here to give some quantitative data derived from operating experience. The writer recalls an instance where a 75-horsepower, squirrel-cage induction motor was started and run regularly on a 75-kilowatt generator and no serious difficulties were ever encountered. The motor drove a centrifugal pump which had always to be filled with water, of course, before starting, thus causing the machine to have to accelerate under more or less load. In another plant a 50-horsepower motor, driving a pump of the same kind, was often operated with a 50-kilowatt alternator, the motor and alternator being designed for the same voltage. Running under full load the motor required a little over 12 amperes, and the generator being a 2,200-volt machine, had a full-load current rating of about the same value. In each lead of the three-phase circuit there was an ammeter having a maximum reading of 20 amperes, and these were never injured by the starting current. Whenever a 75-kilowatt generator could be spared for this service the motor was supplied with power from a switchboard panel equipped with ammeters designed for larger readings. In this latter case the maximum starting current was usually 28 amperes.

The foregoing remarks are not to be taken as recommending the starting of 12-ampere motors through 20-ampere meters.

It is believed, though, that electrical inspectors are sometimes disposed to require heavier motor leads than freedom from fire hazard actually necessitates. If it is insisted upon, the manufacturers will usually supply fuses of the right sort to protect the machine from excessive current during acceleration, and the size of the fuse supplied may generally be taken as a safe guide in determining the necessary carrying capacity of the feeders. In the case of motors designed for especially heavy starting duty, the National Electrical Code specifies definitely the basis of calculation for finding the size of the leads. For ordinary service, however, leads so large as those required here would not seem to be necessary.

THE ANNUAL REPORT OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

On other pages of this issue we present at some length an abstract of the annual report of the American Telephone and Telegraph Company. Under the far-seeing direction of President Theodore N. Vail, this company has been developed into a thing of monumental achievement. The report is more than a mere statement of assets and liabilities, of earn-

ings and expenses. It is a dissertation upon the formulating of big business. It is a philosophy concerning the relations of a leviathan business unit and the public which it serves. A study of the figures showing the extent of operations, the expenditures involved, and the ramifications of the organization necessary to carry on this work will be of interest to everyone concerned in the working out of complex business problems. A more intimate knowledge of the characteristics involved, and the ideals aimed at, will bring about a better realization of the effort which must be made to correlate every department of this great service of communication upon which so much of the acceleration of our business and social life depends.

AN ELECTRICAL METHOD OF CHEMICAL ANALYSIS.

Electrical instruments are among the most sensitive in the possession of the physicist. While the accuracy of electrical measurements is not as great as measurements of length, mass, and a few other quantities, they exceed in accuracy those of a great majority of physical measurements.

Now, Sir Joseph J. Thomson has, by his recent work at the laboratory of Cambridge University, England, shown how, by an electrical method, the most minute quantities of chemical elements may be detected. The delicacy of this method is greater than that of any chemical method. Thomson's apparatus consists of a cathode-ray tube in which the cathode consists of a terminal containing a finely perforated tube. Positive particles of the residual gas attain a high velocity from the action of the electrical field and shoot through this tube to the space behind the cathode. Owing to their positive charge, these particles, moving with a very high velocity, can be deflected by either a magnetic field or an electrical field. If two such fields are superposed normally to each other and to the direction of motion, the particle is deflected in two rectangular directions, the resultant motion being determined by the relative strengths of the two fields and by the speed and mass of the particles. Since the masses of particles of different elements have different values, while carrying the same unit charge of electricity, the particles of different substances are differently deflected. The deflections are observed by placing a screen of some fluorescent material such as willemite at the end of the tube and a spot of light is then formed where the particle impinges upon the screen. Permanent records of the paths of the particles can be obtained by photographic means. Since a single particle, say an atom or a molecule of a substance, is sufficient to indicate its presence by this means, the method forms a very sensitive test of the presence in the tube of any particular element. There is no chemical test which is sensitive to such a minute quantity of a substance, and the method consequently constitutes an electrical test which is far more sensitive than any which has heretofore been available to the chemist.

BOSTON ELECTRIFICATION PROSPECTS.

The movement on behalf of steam-railroad electrification in the larger cities of the country slowly gains strength. The advantages of a smokeless service of increased reliability and speed as demonstrated in the great examples of terminal electrification at New York have become common knowledge, and it only remains for the results of operation through a complete engine stage to furnish the final economic argument which will drive the steam locomotive from the urban field. Boston provides an example of a metropolitan center whose population is gradually awakening to the desirability of electrification, and at each of the last few legislative sessions the General Court has been called upon to consider bills designed to bring about the introduction of electricity. The railroad companies have maintained the attitude that the cost of electrification is prohibitive in proportion to its benefits, and a year or so ago a quadruple board of state commissions by a narrow majority failed to recommend the passage of a law requiring the substitution of electricity within any specific period.

At a recent hearing on the bills pending at the present session, a powerful argument on behalf of electricity was submitted by Mr. Hollis French, a prominent electrical engineer engaged in consulting work in Boston, and a determined effort was made to break away from the policy of dealing with generalities which has characterized much of the former agitation against the steam locomotive. The conclusions of the majority of the Joint Commission were challenged by direct quotations from authorities on electrification like Wilgus, Murray and Gibbs, and by specific reference to the economies and traffic gained in America and Europe in installations from which even partially complete figures have been made available. In electrical circles the vulnerability of the Joint Commission's report is well known, written as it was in large measure by men without electrical training and experience, but the weakness of the report from the technical side has been but little appreciated by the legislative body. It appears from press comment that the probability of the passage of an electrification measure at the present session is not bright, but there is little doubt that the railroad companies will be forced to take the initial steps before many years more have elapsed. Mr. French made a telling hit at the hearing as reported by stating that the time is rapidly approaching when the cost of providing traffic facilities by steam will exceed the expense of electrification itself. The general tendency of the age is against steam as a secondary motive power; the results already attained with electricity are sufficiently attractive to justify its extension; and although its general adoption by the railroads may be held back by anti-corporation agitation on political lines, it is simply bound to come, and unless all signs fail, the next decade will close with great developments from the beginnings which are but the entering wedges of a more complete and efficient service than the world has ever seen.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION.

Semi-Annual Convention, Minneapolis Minn., March 18.

A very successful meeting of the Minnesota Electrical Contractors' Association was held in Minneapolis, Minn., March 18. Headquarters were established in the assembly room of the Builders' Exchange. This convention was one of the three meetings scheduled to be held in Minneapolis during the week of the Electric Show and a large number of out-of-town delegates were in attendance. Business sessions were held in the morning and afternoon with President W. H. Vilett, of the Sterling Electric Company, in the chair.

A considerable portion of the morning session was devoted to a discussion on the subject of electrical contracts with the State. Until recently it has been the practice of the State Board of Control to let contracts for state buildings to a general contractor who in turn would ask for bids from the various sub-contractors. In the discussion the disadvantages of this practice were set forth and the concensus of opinion was that electrical contractors should submit their bids directly to the State Board of Control. To present this recommendation officially a committee consisting of G. M. Jones, George K. Belden and C. Nimis was appointed and instructed to advise the Board that a saving to the State would result if electrical bids were submitted direct.

At the noon intermission the delegates met at Dayton's Tea Room, where luncheon was served.

Immediately following this a vaudeville entertainment was given the contractors by the Minneapolis Newsboys Club. The features included character sketches, songs and a three-round boxing contest.

The afternoon session was given over to an informal discussion on the subject, "How to Secure New Members." Various excellent suggestions were made and it was finally decided to have Secretary Jones conduct a campaign, embodying the numerous suggestions made.

The date and place for the annual meeting was then considered, a vote resulting in the selection of Duluth, Minn., the date being June 16.

Following this meeting the delegates adjourned to the Commercial Club, where the jobbers of the Twin Cities tendered them a banquet. An enjoyable menu was served and after a few remarks by contractors thanking their hosts, adjournment was taken and the Association as a body attended the Electric Show.

Among those in attendance were the following contractors: F. D. Varnum, Vernon Bell, F. G. Goodwin, A. Hubbard, W. Burgess, A. W. Lindgren, G. G. Ryder, L. A. Huller, J. O. Edwards, John Gorman, J. W. Nelson, C. T. Nimis, G. V. Burgess, G. K. Belden, W. H Vilett, J. W. Helm, G. M. Jones, W. J. Chapman, H. S. Olson, T. W. Findley, O. H. Bakke, W. O. Hartig and G. F. Darling.

Convention of the Railway Signal Association.

The Railway Signal Association held its usual early spring meeting in Chicago on March 18, at the Congress Hotel. There were present 181 members, among whom were prominent signal engineers and railway men from all sections of the country. The convention, which was of but one day's duration, had for its prime object the discussion of the preliminary reports of certain important committees of the association, the discussions being in the nature of instructions to guide the respective committees in putting their reports into final form for presentation at the next convention of this organization, which will be held in June.

These reports covered such matters as power interlocking, direct-current relays for signal service, specifications for steel cross-arm pins, specifications for copper or tin-plate channel pins, report on standards, alternating-current signaling, wire specifications, storage batteries, and contracts for the installation of signaling systems. The time being so limited, the discussions were necessarily all rather brief. Subjects which elicited more than the usual amount of discussion were the applications of alternating-current power in railway signal practice and the use of the storage battery in service of this kind. Under the first of these two headings questions of general design, supply and distribution, relays, circuit controllers and other similar subjects were considered in some detail; while under the other heading the discussion was largely confined to the best methods available for charging batteries of the kind in question, the use of the motor-generator set, the mercury-arc rectifier and the gasoline-engine-driven charging unit all being considered. It was pointed out that where direct current can be purchased from local central stations, of the proper voltage for charging batteries, the conditions are ideal. These instances, it was stated, are rare; so that one or another of the three methods mentioned must be resorted to. The engineers seemed to favor the use of the rectifier or of the motor-generator unit.

The next convention of the association will be held in New York some time in June, the exact date not having been fixed yet. C. C. Rosenberg, of Bethlehem, Pa., is the secretary.

Meeting of Meter Committees.

On February 26 and 27, 1912, the Meter Committees of the Association of Edison Illuminating Companies and the National Electric Light Association met jointly in Chicago and invited the representatives of all now existing civic governing and controlling commissions and the meter manufacturers of this country to be present.

It was particularly noteworthy because of the harmony of effort and unity of purpose existing, which evidenced itself continually in the frank discussions which were enthusiastically entered into by the Commissions' representatives as well as those of the manufacturers and the public-utility companies. The principal order of business was the revision of the Meter Code, which was discussed page by page, constructive criticism being obtained from the many viewpoints naturally held by those present. The revised Meter Code, when issued, should meet the approval and requirements of the manufacturers and member companies, and should also be readily acceptable to all Commissions for guidance in framing laws and regulations bearing on modern meter practice.

The Committee on Meters of the N. E. L. A. held a two-day session immediately following the above joint meeting and discussed and revised all material for the Electrical Meterman's Handbook, which will be presented in published form at the Seattle Convention.

Westinghouse Dinner.

The second annual Westinghouse dinner was held in the Fort Pitt Hotel, Pittsburgh, March 16, under the auspices of the Westinghouse Club, composed of the various Westinghouse interests in this district. The idea of having an annual gathering of the employees of the various industries was put into effect last year. The success of the dinner was so great that it was decided to make it an annual affair.

The list of speakers included E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, toastmaster; A. L. Humphrey, vice-president and general manager of the Westinghouse Airbrake Company; E. H. Sniffen, sales manager, Westinghouse Machine Company; T. E. Clifford, general agent, Pittsburgh Meter Company; H. G. Proutt, vice-president and general manager, Union Switch & Signal Company; J. J. Jackson, attorney, Westinghouse Electric & Manufacturing Company; Guy E. Tripp, chairman of the board of directors, Westinghouse Electric & Manufacturing Company; G. W. Guthrie, ex-mayor of Pittsburgh.

Frank Koester.

Within recent years a great deal of attention has been directed toward a study of opportunities for increasing the use of electrical energy in rural communities. Manufacturers of electrical and mechanical apparatus have been developing machines especially adapted to the use of the farmer and to utilities directly connected with farming communities, and state and national engineering and scientific societies have appointed committees to study the needs of the farm and effect a closer co-operation along engineering and utilitarian lines.

Among those who have given this subject special study and to whose energy and perseverance much of the development which has taken place is due, is Frank Koester, consulting engineer, of New York. Mr. Koester is the author of a series of articles upon opportunities for the use of electrical energy in agricultural communities now appearing in this journal. These articles have attracted wide attention from central station managers, consulting engineers, electricians and manufacturers of electrical and farm machinery. He is engaged also upon the preparation of a volume which will contain an extended study of this subject, introducing a great deal of information which will be of practical value to the farmer as well as the engineer and technical student.

Frank Koester,
Consulting Electrical Engineer.

Mr. Koester received his training in Germany, where he spent four years at a technical school, three years in shop and field experience, and four years in general engineering work. He has devoted a great deal of time to the design and construction of power plants in Norway, Germany, Austria, Japan and America. He came to the United States in 1902, and was engaged in the engineering work of the Interborough Rapid Transit Company. Upon completing this work he became associated with a firm of consulting engineers in New York, with whom he designed a large number of power plants. He also worked on a project for the heating system of the Government buildings in Washington, D. C., and in connection with this enterprise he made, in 1906, a report of modern European heating systems, using superheated steam in the transmission piping. With his wide experience in power-plant practice and the study of power-plant economics, he has been called upon to make a number of tests and reports on isolated plants and central-station systems. One of the latest of these was for the Consolidated Gas, Electric Light & Power Company of Baltimore, where he pointed out a yearly saving of $50,000 in the running expenses. Mr. Koester is the author of a number of scientific papers, and he has been a prolific contributor to the technical press of both this and foreign countries. His two volumes, entitled respectively, "Steam-Electric Power Plants" and "Hydroelectric Developments and Power-Plant Engineering," are standards on their subjects and have been adopted as text books in a number of educational institutions. He has also made a study of and contributed a number of articles on the education of the engineer and the relation of the engineer to his clients.

Boston Electrification.

The Committee on Railroads of the Massachusetts Legislature has reported favorably a bill which makes electrification of all the railroads entering Boston compulsory. Electrification must be completed by 1920, and is to extend throughout the Metropolitan Park system, which has a radius of about 15 miles from the State House.

Canal-Zone Wireless Stations.

George O. Squier, assistant to the Chief Signal Officer, United States Army, has been detailed to go to the Canal Zone to select the sites for five local wireless stations, and to pick out the most suitable site for the proposed new high-powered wireless station, similar to the Arlington station at Washington, which is to be established somewhere along the Panama Canal. Major Squier has also been detailed to make some preliminary investigations at the fortifications to be erected in connection with the Canal for the purpose of making plans to adopt some late devices in fire-control systems.

Upon his return from the Canal, Major Squier will spend a month in inspection work in and around Chicago.

Major Squier has been designated by the Department of State as military attache to the Court of St. James, and will leave America in June for his new post. He will represent the United States at the International Wireless Convention to be held in London next summer. This appointment to the most coveted foreign detail in the United States Army, it is said, at the War Department, was given to Major Squier entirely without solicitation or knowledge on his part, and came to him as an absolute surprise. It is understood in Washington that the appointment was sought for him by his superiors as somewhat in the nature of a reward for his inventions in electrical science, which have been of a highly practical nature, and from which Major Squier, being an army officer, receives, of course, no pecuniary return.

Government Ownership of Telephones.

A bill has been introduced in the federal House of Representatives to provide for the condemnation, acquisition, and construction by the United States of the telephone lines, properties and holdings in the United States and to provide for the operation of same by the United States. The power to determine the market value of the properties thus to be acquired is to be vested in the Interstate Commerce Commission, and that body, the Postmaster General and the Commissioner of Telephones, an official to be appointed, are to decide which company should be proceeded against first.

Recent Developments in Generating and Converting Apparatus.

Over 100 members were present at the second meeting of the Technical Division of the Commonwealth Edison Section, N. E. L. A., held in Chicago, Ill., on March 13, at the rooms of the Western Society of Engineers. P. B. Juhnke, chairman of the Technical Division, presided.

G. C. Johnson, of the Quarry Street Station, spoke briefly of the changes in design that had come with the use of larger units, mentioning the bad regulation of former types, and the good regulation of the later machines. This good regulation necessitated the use of reactance coils as a protective measure. He also spoke of the practice of the company in grounding one lead of each generator.

A number of recent improvements in the Quarry, Fisk and Northwest stations were mentioned, especial attention being called to the new disconnects which lock open or shut, but cannot be left in an intermediate position. Switchboards, meters, etc., have been greatly improved in the past few years and many instruments unknown until a short time ago are now regarded as necessary appliances. Mr. Johnson showed a number of interesting lantern slides.

The second paper, entitled "Features of the Northwest Stations," was read by C. L. Frisbie, of the testing laboratory. Beginning with the exciter system, he described the entire electrical equipment of the station. One of the novel features was the arrangement for reading temperatures of the turbines from the switchboards.

Cable sheaths are all grounded by high-tension fuses, relay signals being employed to indicate grounds by ringing a bell. Lamps in the station indicate the phase grounded.

Reactance coils are not used at the Northwest Station, auto-transformers taking the place of this device, and allowing the use of turbines generating at 4,500 volts, or one-half the system voltage. Each transformer is placed on a truck, running on rails, so that a replacement may be easily made, or a transformer readily removed for repairs.

Several lantern slides were shown, among which was one of a special testing set erected to run the necessary tests on the station.

In discussion of the papers, P. Junkersfeld spoke briefly of the early experience with turbines, and the accidents which were unavoidable at the start with this type of apparatus. The liability of self destruction was much greater than with engine-driven generators, until protective devices were thought out. He commented on the value of induction generators in special cases, this type of apparatus proving very economical with engine-driven machines. One interesting point is that the machines are entirely automatic, and hence need no governors. Mr. Junkersfeld called attention to the excellent efficiency of the new high-speed turbine units at present being built. Some under design are to operate at speeds unthought of a few years ago.

R. F. Schuchardt mentioned the pioneer work that had always been done by the Commonwealth Edison Company. The company, as is well known, was the first to employ a three-phase transmission system and installed in 1902, at Fisk Street, the first vertical turbine to be used commercially. At that time many engineers said the proposition was impossible and that such a heavy vertical rotating part would not work. The company was also the first to use a vertical rotary converter and a vertical motor-generator set.

He prophesied further developments along the same lines and remarked that large 60-cycle rotaries would doubtless be employed in the near future.

Mr. Junkersfeld brought out some interesting points as to the real reason for the great success of the central station, saying that this was based on two things: (1) the advantages of centralized production and, (2) the diversity-factor that comes with a big power and lighting load. He stated that the load-factor in Chicago during the past year was 44 per cent while that in New York was only 30 per cent; in other words, Chicago obtained about 50 per cent more for each dollar invested than did New York. Messrs. Roper, Macrae, Foster and a number of others also joined in the discussion.

The Properties of Dielectrics.

In an article in the London *Electrician*, G. L. Addenbrooke gives the results of some experiments showing the dependence of the power loss in a dielectric upon the frequency of alteration. For good dielectrics the watts are found to be proportional to the frequency. For some of the poorer dielectrics, however, the power decreases as the frequency is decreased but the relation is not a proportional one, as the loss does not become zero for very slow reversals. Celluloid and other materials of comparatively low resistance come in this class.

For liquid dielectrics the results are similar to those for a good solid dielectric when free from moisture. With a slight amount of moisture the behavior is similar to celluloid. With larger quantities of moisture the loss becomes constant for a large range of frequencies, so long as the applied pressure is alternating; for a direct voltage, however, the loss drops to about one-sixth of this value.

These results do not agree with the view which has sometimes been expressed that dielectrics are made up of molecular resistances and capacities in series.

Banquet of Louisville Contractors.

As a culmination of some excellent work which has been done during the past year, the second annual banquet of the Electrical Contractors' Association of Louisville, Ky., was held at the Tyler Hotel in that city on the evening of March 15. The affair was one of the most enjoyable social sessions the Association has had, and enabled the members to let loose some of the energy they had stored up as a result of the business meetings which have been held monthly since the Association was organized.

The dinner was presided over by C. C. Childers, as toastmaster. Mr. Childers made a sparkling introductory address and spoke about the work of the organization, emphasizing the fact that it is for the purpose of enabling the members of the trade to pull together instead of to work against one another. All of the talks were along the same line. Many guests were present, the inspection departments of the lighting companies, the Board of Fire Underwriters and others being on hand. Walter Meyer, who is connected with the commercial power department of the Kentucky Electric Company, spoke for the central-station men who were present.

Half a dozen talks were made, and the spirit of good fellowship which the dinner was intended to develop was in evidence all the way through. Nearly 30 were present, and the banquet was voted an even more successful event than the first, which was held a year ago.

Efforts are being made by the Association to improve relations between the contractors and the lighting companies. Of late, harmony is said to have been conspicuous by its absence, and for that reason it is extremely desirable that new relations be inaugurated. It is understood that better relations are now being worked out, and that the wiring of buildings and industrial plants will be accompanied with less friction than heretofore. The Association, which is affiliated with the national body, has the following officers: Frank Goode, president; C. C. Childers, vice-president; Gus Albright, secretary, and Joseph Neal, treasurer.

Electricity in Agriculture.[1]

Transportation of Farm Products—Irrigation—Electric Forcement of Vegetation.

By Frank Koester.

Transportation of Farm Products.

The problem of transportation on a farm of any size is a factor of great importance; particularly is this emphasized in unsettled weather, when the products have to be carried to the barns or other store houses to avoid their being left out in the rain.

Machinery has been invented, applied and is used today in a multitude of cases where physical labor was relied upon in the past. For thousands of years trackless transportation has been dependent on the physical exertion of man or some other animal. Today machinery is ready to do this work. The self-propelled electric vehicle fills the gap and needs only the highway leading from here to there.

In considering any method of transportation, there are three things to examine: The road, the load and the vehicle. In trackless transportation the road must be accepted as it exists. In commercial work the load must be accepted as it is received, and it must be delivered as ordered. These two factors of transportation are the same, no matter what method is employed. Hills, bad roads, frequent stops and starts, long routes or heavy loads, are equal in the demand made on animals or machines of any kind. The third factor, the vehicle, is the only one with which the solution of transportation problems can be made easier.

Just as the electric street car has solved the problems for passenger transportation in cities, so has the electrically driven power wagon opened the way to a simple freight and delivery system.

The electric vehicle for trucking and delivery is purely a mechanical proposition. It is a machine. Like other machines, it can be built to do a given amount of work in a definite time at a certain cost under any known conditions.

The safely carried load in pounds or tons is the basis of its mechanical design and construction. The specified speed with full load on a hard level determines how much power will be required. The specified duration of con-

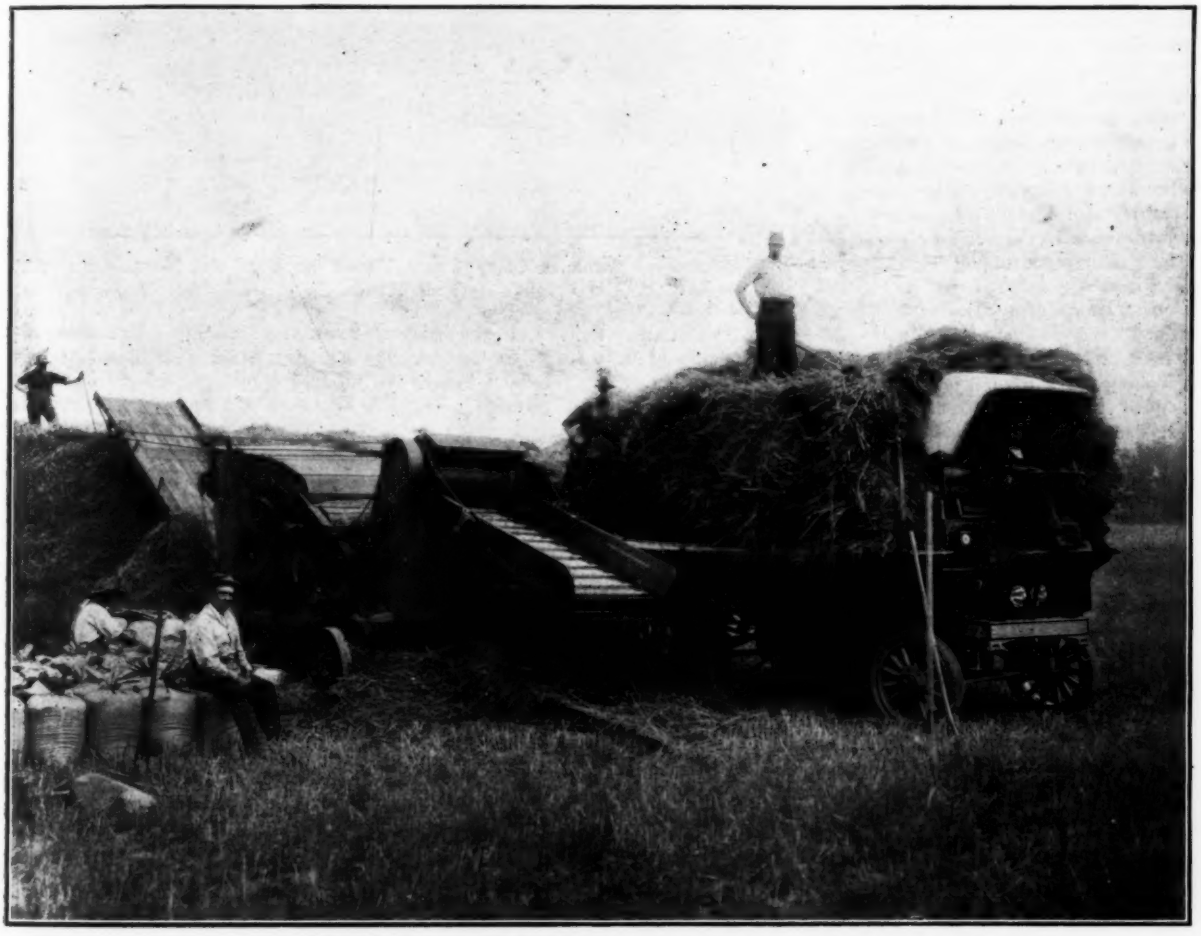


Fig. 1.—Electrically Propelled Vehicles for Harvesting Wheat and Straw.

[1] Copyright, 1912, by Frank Koester, New York.

tinuous operation at full load on a hard level determines the amount of energy that must be stored in its battery at one time. This last condition fixes the size of the storage battery. The power and speed required determine the size of the motor and the gear ratios, while the total weight affects the tire design.

The cost of transportation by electric vehicles can be determined just as logically as the cost of operation of any other machine. It is merely a question of measuring the work and measuring the cost and placing one against the other.

Accurate engineering can be applied to the problems of transportation with greater satisfaction with electric vehicles than with any other type. Electrical measuring instruments reveal, and record, if necessary, the condition and performance of storage batteries and electric motors. The cost of producing electricity is a known quantity. The amount of electricity necessary to charge a battery is measureable. The amount of electricity delivered to an electric motor by the battery is a known quantity, or can be measured. The performance of an electric motor is accurately specified for any conditions. Its efficiency is easily determined.

The work of moving a ton a mile per hour on a hard level road is expended in starting it from rest and in overcoming the resistance of the road, the tires, the bearings, the electrical circuits and the air. If the road is not hard or not level of course more work will be required to overcome its resistance or to move the load up a grade. If it is necessary to start often from rest more work must be done than for continuous motion.

The cost of doing this work depends on the amount of energy expended and the cost per unit of power.

The electric vehicle cannot be used profitably where it is not needed. Where the work to be done is less than half the ability of the machine, proper value may not be derived from the investment. There are also localities where operating conditions prevent a satisfactory return for investment.

But in thousands of cases the operator of a few delivery wagons, a couple of trucks or two or three heavy drays, can profit at once by replacing them with one or more electric vehicles. His work will be done quicker, his stable may be smaller and his expense will be much less for a given service.

Where a large number of vehicles is used the advantage of electricity becomes more apparent and the efficiency of the service is improved still more.

An example of the utilization of electric trucks for transportation purposes is cited. The nursery of the Brown Brothers is located about four miles from the business section of Rochester, N. Y., and during the shipping season the firm employs a 3.5-ton electric truck for delivering trees and shrubs to the depot; the truck returning with fertilizers and supplies for the nursery. During the harvest season, the same truck is utilized in harvesting the hay and wheat. An ordinary load is 617 bundles of wheat, which after being threshed yields 45 bushels. The regular two-horse load is 260 bundles. Where the time element in getting the wheat to the thresher, due to variable conditions of the weather, is so important, one can readily perceive how progressive farmers can avail themselves of modern appliances.

Fig. 2.—Electric Vehicles Carry Three Times the Load and Eliminate Extra Farm Hands.

The price paid for an electric vehicle does not necessarily determine its real value to the owner; in fact, it depends on the use to which it will be subjected, and of course, upon its constructive features. There are many farmers who desire a pleasure vehicle,

Fig. 3.—An Ordinary Load is 617 Bundles of Wheat.

and who do not have sufficient produce to handle to warrant the purchase of an electric truck for transportation purposes only. They should choose, therefore, a type which is suitable both for light trucking and pleasure. To suit country road conditions, such a vehicle should have high wheels and solid rubber tires.

Fig. 4.—An Industrial Railway for Handling Farm Products on a German Farm.

A more extensive system of transportation for farms of more than ordinary size, is an industrial railway, consisting, in essential features, of a narrow-gauge track, a copper electric conductor strung some 12 feet above the tracks, and an electric locomotive. Current is sent to the locomotive over the copper wire, and returned to the generator through the tracks. The electric locomotive is somewhat similar to the ordinary trolley car on a smaller scale, and is capable of hauling a number of cars, depending upon the capacity of the locomotive. In one instance, a transportation system which once employed horses to haul the cars over the rails now uses electric locomotives. Within three years the total yearly haulage of the system has increased three times. Farm products can be loaded, transported and unloaded in the places desired. In almost all instances the tracks can be brought into the storehouse or barn; a train load of products can be brought right in and the locomotive sent back for another train load taking empty cars along.

Fig. 5.—Ten-Horsepower Motor and Controller Operating Hay Hoist, Miner's Heart's Delight Farm, Chazy, N. Y.

For loading and unloading the farm products at the barn small motor-operated hoists are used to lessen the labors of such operations. With a single lift, a whole load of hay, wheat or straw, can be taken from the wagon and placed in the loft. With manual labor, usually three to four men are often required to shift a load of hay, while with an electrically operated hoist one man can do the same work and consume only a fraction of the time required by manual labor. The cost for electrical energy is almost negligible, when compared with the number of hands required for manual labor.

Power Requirements for Irrigation.

With a suitable motor, water for irrigation may be raised to practically any desirable height. As the water is best distributed during the night-time, the pumps may operate at this time to advantage, because the usual day load has fallen off. Where the farmer has his own isolated plant, this can be run a few hours longer than usual, otherwise he buys his current from the service company at a special rate.

The acreage that may be watered by any given supply varies greatly in different localities and for different crops.

Some fields in semi-arid regions need only one flooding each summer, while in the most unfavorable places water must be supplied at least once per week.

Shallow soil, over clay or hardpan, holds its water too near the surface, permitting rapid evaporation. Loose, sandy subsoil permits the water to sink or to pass to other substrata, slightly benefiting adjacent fields to the detriment of the field irrigated.

Deep, sandy loam soil, with clay or hardpan subsoil, gives the best returns for a given amount of water.

The crop itself in an irrigated field absorbs very little water, but to enable this small supply to be constantly available to the plants a liberal supply must be furnished to replace that which is lost by surface evaporation.

To replace surface evaporation, three to seven gallons per minute are required for each acre in semi-arid regions, and from fifteen to twenty gallons per minute per acre in the arid regions.

Surfaces covered with alfalfa or similar dense growth require less water than crops planted in rows with bare ground between, unless by constant cul-

tivation a layer of loose earth several inches deep covers the surface and lessens the evaporative effect of the atmosphere.

Alfalfa, south of the fortieth degree of latitude, and red clover north, are the most profitable forage and hay crops on irrigated farms. Both require a liberal supply of water the first year, less the second, and very little thereafter; consequently when the first field is a year old, another may be planted, and so on until the acreage will take up the entire water supply.

Fields well flooded in winter will need less water in the spring and summer; therefore by taking advantage of the brisk winter winds a much larger area may be irrigated than if spring and summer flooding alone is practiced.

The motor-driven pumps are preferably located in small houses, scattered over the field to be irrigated. They may lift the water directly into elevated reservoirs, or pump the water directly into trenches.

Where the fields can be leveled off, embanked, and main or feeder ditches run on embankments above the level of the fields, the flooding system may be used. As not less than three inches of water should be run on at once, the field should be divided into plots having four times the area of the reservoir for each available foot of its depth.

Furrow irrigation on small plantations seems to be the favorite system. Furrows are run between rows five to fifteen feet apart. If the field is not level, the furrows should run in such direction as to keep each furrow nearly on a level throughout its length. When the main ditch is flooded, the bank opposite each furrow is broken down, allowing the furrows to fill successively.

In orchards, the furrows are made in circles six or eight feet in diameter around each tree. This brings the water well over the roots, but not against the trunk of the tree. Water should not be allowed to come in contact with the bark of the tree. The small circular ditches may be fed by main ditches between every alternate row. Where great economy of water is needed, large tiles are sunk into the ground near each tree, or twelve or sixteen feet apart in a vegetable garden, the water being led into these tiles by means of a ditch or hose. This system conducts the water well below the surface, preventing much of the loss by evaporation.

The advantage of using electrically operated pumps in various sections of the farm is obvious, so that in addition to the irrigation system, the several sections may be sprinkled by a hose connected to the pump or the piping system supplied by same.

The motors may be permanently placed in any section, or a single motor pump mounted on a truck, and carried from place to place, and connected to a deep-well suction pipe.

The source of water supply may be either surface water from streams, or may be ground water, secured by sinking wells. Irrigation by gravity systems can, of course, be accomplished only in those favored localities which have a natural source of water supply at a level higher than the tract under cultivation. Such locations have in many localities been appropriated, so that further extensions are dependent upon some source of power for pumping. Long distance-transmission lines, carrying power from the mountain streams and water falls over the intervening dry plains to the growing cities and towns of Colorado, California, Nevada, Oregon, Washington and Idaho, have made possible the use of electric motors for the operation of pumps for irrigation purposes. In fact, the ease and economy with which electricity can be transmitted over wide areas and used to drive motors, makes electric pumping in many cases preferable to the gravity system. The pumps can be in comparatively small units, each supplying a local area. The distributing ditches are small, thus leaving maximum area for crops, and the water supply to each area is always under perfect control. There is minimum danger of broken ditches and flooded crops, such as sometimes occur with large ditches.

The sage brush and sand covered plains of these states, when properly cultivated and flooded with water, produce the wonderful grapes, melons, peaches, cherries, apples, strawberries, etc., which are now common in the markets of this country. Land which less than a decade ago could be purchased for from fifty cents to two dollars an acre in the valley of the Columbia, is now holding its own at $150 an acre for alfalfa hay land, producing three crops a year and averaging four to nine tons an acre at $10 per ton. The condition of affairs has brought these lands before investors, large and small, from all parts of the country, and where ten years ago individuals held vast areas of this cheap land, the rising values have now reversed these conditions. Increasing numbers of settlers hold smaller tracts, and dividing and sub-dividing is constantly going on. Intensive cultivation is the secret of successful irrigation to the man of moderate desires, and with the same amount of attention and care bestowed upon

Fig. 6.—Electrically Operated Pump for Irrigation System on German Farm.

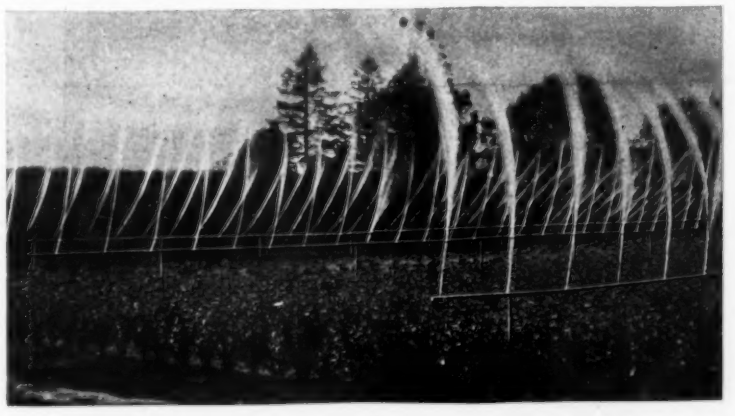


Fig. 7.—Motor-Driven Pumps Supply Pressure for Irrigating this Field.

the land ten to twenty acres or even less of good irrigated land will produce more than larger areas in the East, particularly when devoted to the raising of fruits.

The results obtained by this intensive method of cultivation of small unit areas of land have been the greatest factor in opening up the various tracts of irrigable lands in the Pacific Coast States. Organized companies have taken up tracts of land in units from 160 to 6,000 acres and have divided them into small tracts of 5, 10, 20 and 40 acres each and sold them to homeseekers, with water rights at prices ranging from $100 to $600 per acre, the land being in its original prairie form but with the water delivered thereto.

A concrete example, according to *Electric Journal* of an operating company in the upper Columbia River Valley may be of interest. This company has taken a 160-acre unit of sage brush land, plotted it into five and ten-acre tracts and supplied it with water under a pressure system. The pumping station consists of a 40-horsepower, three-phase, 60-cycle, 2,300-volt, wound-secondary induction motor, direct-connected to two 3.5-inch and one 5-inch centrifugal pumps. These pumps are so arranged that they may be run in single, multiple or series stages to supply water for the different heads to be pumped against. They have the following duty:

250 gallons per minute to a head of 190 feet, all three pumps in series.

500 gallons per minute to a head of 160 feet, two small pumps in parallel pumping into the large unit.

750 gallons per minute to a head of 110 feet; the arrangement being the same as with 160-foot head, but the pumps operating on reduced head and picking up more water.

500 gallons per minute to a head of 55 feet, the five-inch pump working alone as a single-step pump.

The main discharge system from the pumping system is a 12-inch double-riveted flanged steel pipe, 1,700 feet long. The lateral system is made up of galvanized sheet-steel pipe of various diameters, branching from the main discharge line and having at intervals one-inch stand pipes about two feet long, with valves which feed the water into the small distributing ditches. The loss of water by evaporation is thus minimized, and by means of the standpipe system the irrigator is enabled to control the flow as he works on the distributing ditches.

This system proves more economical to the holder of the small five and ten-acre tract than would obtain if he had to purchase an individual pumping equipment for this land, as the power and land company carries the necessary investment for sub-stations, pumping stations and water distributing systems. Although he pays more for an acre of his land under these conditions, the terms of sale are such as to make it less of a financial burden than would the individual unit pumping plant.

In this particular case, assuming a load factor of 80 per cent on the pumping plant on 24-hour service, the average station load would be about 32-horsepower. It would thus be easy to keep the mechanical equipment in good running condition, even though the full load of forty horsepower might be carried at times for short intervals. Basing the power bill at $7 per month per horsepower on the peak or maximum demand, the charge would be $280 per month as a possible maximum, or $1.75 per acre per month for the 160 acres affected. The water could thus be delivered at a maximum cost of $17.50 per month for a ten-acre tract from a central pumping plant, where an individual plant of, say, a three-horsepower unit would require a monthly charge at a higher rate per horsepower, besides the maintenance, attention and cash investment.

These figures, of course, are roughly comparative, as the cost of power differs materially in different localities, but they indicate in a general way the advantage secured by the small owner, in getting his water from a central unit station rather than putting in the small individual unit. The tendency is increasing, therefore, towards the installation of larger sized pumping units to supply sub-divided tracts of land, both

Fig. 8.—Melons Grown by Electricity.

Fig. 9.—Office of a Nursery, Showing Electrically Forced Flowers.

on account of the economy in stepdown transforming stations in larger sized units and for the reason that where power is purchased the large sizes of pumping equipment offer more opportunities to make the installation along good engineering lines, and to build the station and equipment with machinery of high class manufacture, reliability and efficiency.

Electric Forcement of Vegetation.

The possibility of increasing crops by electrical stimulation is a fascinating subject, which has occupied the attention of a few scientists, since it was discovered that seeds subjected to electrical stimulation germinated earlier than untreated seeds. Tests have been made at various experimental studios here and abroad, showing that both electrical illumination and currents passed through the soil increase the rapidity of growth and also improve crops. The action of the electrical current used either as an illuminant or for direct stimulation of the roots seems to be somewhat analogous to that of a tonic in the human body. The extent to which the electric current as indicated may be utilized in any special case will depend upon the character of the farm, the surrounding conditions and the weather.

The principal process by which electrical energy forces the growth of vegetation consists in producing ozone and nitrate compounds and forcing them into the capillary tubes of the plants, when the electrical energy passes from a conductor to the ground.

The method of applying electrical energy to force vegetation is in general after the following system. A netting or copper wire is supported over the area under cultivation, from short poles driven into the ground at regular intervals. To insure a good result, small barbs are woven into the net or copper wire with points projecting downwards. The wires or the net are carried about 12 feet high or high enough to clear a good sized farm wagon. On the poles the wires are carried on porcelain insulators.

One of the feed wires from the machine furnishing the electrical energy is connected to the net or overhead wires; the other is connected to a copper plate sunk into the moist ground, to insure best results.

The action of the electrical machine on the system is as follows. When the machine is put in action, electrical current is generated and goes over the net or overhead wires in the field, then out of the barbed points into the ground. In passing through the air, the current causes ozone and nitrous compounds in gaseous state to be formed. These gases are taken up by the moisture on the surface of the ground and forced into the ground, traveling in the direction of the current. To complete the action, the current next goes from the ground to the wires overhead. In doing so, the chemical compounds formed on the previous passages are now forced up into the capillary system of the plants and into the sap of the plant. This action corresponds to a tonic and increases the growth of the stems, leaves, buds, etc. The quality of the plant itself is increased.

This action of passing into and out of the system completes or makes what is known as a cycle. The frequency or rapidity with which these changes take place, depends entirely upon the speed at which the electrical machine is operated. The strength of the current and pressure at which the energy is generated depend solely upon the type and construction of the machine. A large machine does not necessarily mean a large amount of energy; it is possible to combine a number of small parts to form a compact yet powerful machine, which in size would not measure more than a third of a large machine of the same capacity.

Another system which has been tried and given some results, is by putting up arc lamps in the region cultivated, thus furnishing artificial sunlight, and bringing plants to maturity in less time than without the lamps.

Up to this time, what has been done in this branch of the engineering art has principally been in Sweden, England, Germany and other European countries. The results have thus far proven that electric energy does have an advantageous influence on vegetation, but as yet have not reached the stage of being a commercial success.

To cite a prominent experiment of what has been done with electrical air current, that conducted by Dr. Pringsheim in the fields near Breslau in the summer of 1902 is of note. The experimental field covered about 1,200 square feet. The machine used was driven by a motor fed from a storage battery. The following figures give the results in percentage increase of the effect of the electric influence upon the growth of the plants under experiment. Strawberries, 50; carrots, 13; potatoes, averaging 21; barley, averaging 10; oats, averaging 22.

The experiments conducted in Durham, England, proved that the conditions of the air and soil affect the action of electric influence in vegetation very greatly; the presence of moisture plays an important part; a well watered field seems to have, in the majority of cases, an advantage over one with little or no water.

For a more complete study of the forcement of vegetation by electricity, see the article by F. L. Cook, "The Growth of Plants by Means of Electricity," in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, November 11, 1911.

Lighting of City Hall, Louisville.

David Lyman, city engineer of Louisville, Ky., has completed plans for the exterior illumination of the City Hall. Eleven handsome bronze standards, each surmounted by a single tungsten lamp, upright, and four corresponding tungstens, pendant, are to border the corner of Sixth and Jefferson Streets, one on the corner and five along each side of the City Hall and Annex. Several dozen artistic bronze brackets, each surmounted by a cluster of lamps, are being made, and will be affixed to the massive stone building itself as a finishing touch to the scheme of complete illumination. Upon various occasions the City Hall has been outlined in incandescent lights, but the present work constitutes an initial effort at permanent beautification of the structure through up-to-date lighting.

Examination for Superintendent of Telephone Construction.

The United States Civil Service Commission announces that on May 29 an examination will be held for the position of superintendent of telephone construction in the Forest Service, Department of Agriculture. The salary is $1,500 per year and the age limit 28 to 45. Applicants should be physically strong and of good health, active and able to stand exposure incident to employment in the national forests.

It is desired to secure a man of broad experience, who will be able to study the needs of the telephone service of this district (No. 1) as a whole, and who will be capable of planning for future growth on a broad and permanent basis.

Electric Furnace at Sharon.

It is reported at Sharon, Pa., on the authority of prominent engineers, that the National Malleable Castings Company is preparing to install an electric furnace at its plant at Sharon for refining steel for special castings. This will be the first electric furnace in the Pittsburgh district to be utilized exclusively for castings. The Firth-Sterling Steel Company has a 2.5-ton electric furnace in operation at its plant at Demmler, and the Carnegie Company has an electric installation at Homestead.

Copper exports for the week ended March 14 totaled 5,114 tons; since March 1, 11,690 tons.

Commercial Practice
Management, Rates, New Business

Central-Station Service for Keeping Flies Off Horses.

An ingenius scheme devised by the Whiteside Bakery Company, of Louisville, Ky., for the comfort of its 90 horses in summer is worthy of note as opening a new field for central-station service. The company found that to obtain maximum service from its horses during the hot summer months it was necessary for them to have complete rest while in the stable. With this in view a shaft was suspended over each row of stalls to which was attached two canvas-covered "paddles," over each stall. The shafts are all driven by a one-horsepower motor. The speed of the shafts is sufficiently low to create just enough breeze to keep the flies off of the horses, without chilling them. A view of a section of this equipment is shown in the accompanying illustration. Energy for this motor and numerous others installed in the bakery is supplied by the Louisville Lighting Company.

Fan Equipment in Stable of Whiteside Bakery Company.

Of course the time is near when the remaining horses in commercial service will be replaced by the more efficient and economical electric vehicle. However, while horses are still in service, the Whiteside Bakery Company has shown how to properly take care of them in summer. The company "horse fan" is inexpensive and entirely satisfactory.

Ohio Lighting Company Spreads Out.

The Greenville Electric Light & Power Company, Greenville, O., is extending its network of distribution to reach the Ohio towns of New Madison, Eldorado, West Manchester, Lewisburg and Brookville. This will give the Greenville company a population of some 4,100 people. The company has been very successful in reaching out and supplying small communities. The company carries its transmission lines to the township line and then the township company purchases the current and distributes it. The Greenville company sells current to the township distributing companies at 4.5 cents per kilowatt-hour. The company has been supplying the towns of Ansonia, Bradford, etc.

Central-Station Conditions in Cherryvale, Kan.

Considering the size of the town, Cherryvale, Kan., has a central station that is establishing an unusual record for new business. Under the direction of C. A. Martin, manager, the Cherryvale Electric Light & Power Company has during the past two years increased its motor load from 30 horsepower to over 400 horsepower. Lighting and residential business has been increased proportionally.

At present, plans are being perfected for the installation of an ornamental street-lighting installation, comprising about 175 lamps. All work will be done by the company and a flat rate of about $2.00 per 25 feet of frontage will be charged. It is expected that the city and property owners will share the charge.

One contract for power recently closed, of which the company is justly proud, is for city water pumping. This was secured after the city had voted bonds for a municipal installation.

To take care of the rapidly increasing business extensive additions to the company's system are now under way. The generating capacity of the station is being increased by 200 kilowatts and several new pole lines are being constructed.

White Way in Louisville.

As a result of missionary work on the part of George G. Fetter, president of the Fetter Heating & Lighting Company, of Louisville, Ky., Main Street in that city, from Fourth to Fifth Avenues, is to be equipped as a "Little White Way" in the near future. Mr. Fetter has secured the approval of every business house along the square for his plan, and will proceed at once with the erection of a number of handsome lighting standards to illuminate the heart of the city's wholesale district from dusk to dawn throughout the year.

When Main Street is ordained as a "White Way" the last move for up-to-date electric lighting for the downtown section of Louisville will have been completed. Jefferson Street, from Second Street to Fifth Avenue, and Market Street, from Second to Seventh Streets, have been improved.

CARD FORMS FOR PLANT RECORDS.

By R. H. Pickens.

Few hydroelectric stations keep any complete or comprehensive records of operation or repairs. It is true that the majority keep very complete and thorough records of the output as shown by the switchboard meters, also records of the head water, tail water, weather conditions, etc., but very little attention is given to consumption of supplies, such as oil, grease, waste, armature coils, governor parts, and like items. No records are kept relative to the efficient working of the men, how long it takes each man to do any certain piece of work, what ability he shows, etc. It might be well to remark that, granted efficient apparatus, the efficiency of a station depends upon the efficiency of the attendants.

Herewith are given two suggestive forms that will enable the keeping of records; these cards can be placed on file for future reference.

These cards can be filed under two designations, *A* for cards relative to lubricants, *B* relative to repairs and efficiency of the attendants.

This system of keeping records can be applied not only to hydroelectric stations but to steam-electric stations as well, in fact this system is applicable to any industrial plant, no matter what its form of motive power, where the motive power is under the supervision of a separate body of men known as the engineers.

As there are no two stations that have like conditions of operation or the same arrangement of apparatus, it is impossible to give forms covering all stations, yet two forms of cards, with suitable columns, are amply sufficient for any size or type of station.

These records should be kept by the chief engineer, superintendent, foreman or some other reliable person, it being well to bear in mind that the value of any system of records depends altogether upon the care with which they are kept. A badly kept record will not be of the slightest value to the management.

LUBRICANTS AND WASTE

DATE	ENGINE OIL	SHAFTING OIL	FILTERED OIL	GEAR GREASE	CUP GREASE	WASTE	DRAWN BY
1/5	10 gals			5 lbs	8 lbs		Bowen
1/6						5 pounds	Christopher
1/20		15 gals	12 gals				

REPAIRS

APPARATUS Lombard governor #1 MAKERS NO 2417A Type B
REPAIRS BY C. A. Arthur PARTS USED 1 priming check &
SIMILAR PARTS ON HAND Three
SIMILAR PARTS ORDERED one-half dozen

Remarks Did not show proper precaution in preventing waste & oil. Time 45 minutes slightly too long

Card Forms for Plant Records.

Dock Company Will Use Motor-Driven Pumps.

The Dravosburg Dock Company has found hand pumps too slow for the work at its plant and has decided to install specially designed motor-driven pumps for emptying the chambers of the docks. The concern has large docks on the Monongahela River, at Dravosburg, near Pittsburgh, Pa. Barges used on the local rivers are repaired at this plant.

Central-Station Power for Electric Railways.

Since November 1, 1911, the Philadelphia Electric Company has been supplying power to the Philadelphia Rapid Transit Company to the extent of about 8,000 kilowatts. This is delivered at 13,000 volts. An additional contract has recently been closed providing for 15,000 kilowatts, to be delivered by November 15, 1912, and 5,000 kilowatts additional to be delivered in 1913. Provision has also been made for power supply in the outlying districts and for the suburban lines in Delaware County.

Franchises Granted In Defiance.

The Defiance Utilities Company has been granted a franchise for supplying electric current in Defiance, O. Power will be supplied from the new station by the Auglaize Power Company, which has a capacity of 8,000 horsepower. A rate of 5.4 cents per kilowatt-hour will be charged for lighting and not more than 3.5 cents per unit for power. The ordinance granting the franchises limits the rates to these values.

Special Rates for Churches.

All churches, hospitals and charitable institutions supplied by the Philadelphia Electric Company are granted a discount of 33.3 per cent on bills exceeding $15 per month, and all bills of $10 to $15 are made $10 net. This means a rate of 6.7 cents per kilowatt-hour except in those portions which have underground distribution, where the rate will be 8 cents per kilowatt-hour net. The same discounts are made to residences in the outlying districts, but not in the underground district.

Pittsburgh Lumber Concern Adopts Electric Drive.

Electrical power will soon take the place of steam in the plant of the Bruckman Lumber Company, Pittsburgh, Pa. The concern recently changed its location and in an effort to lower the power costs had estimates prepared showing the comparative costs of steam, gas-engine and motor-driven operation. It was finally brought out that a saving of about 50 per cent would be made by the use of electrical power. Bids have been asked for the installation of the necessary equipment to operate 26 wood-working machines. The change will mean an outlay of about $4,000. About 215 horsepower will be required. This will be secured from a local light company.

Electrical Construction

SOME INTERESTING DETAILS OF THE ELECTRIC WIRING IN A LARGE OFFICE BUILDING.

By F. G. Waldenfels.

In cities where the better methods of electrical construction prevail office-building wiring has largely become a matter of standard practice. The installation described in this paper, however, possesses many features sufficiently new, it is believed, to make the article valuable not only to the general electrical contractor but to those who make a specialty of the wiring of office buildings as well.

The Insurance Exchange Building, which is just now being completed, is one of the largest and most modern office buildings in the city of Chicago. It is twenty-one stories high, of modern fireproof, steel construction, and rests upon caisson foundations which extend down to bedrock. Any detailed or lengthy description of the building itself, however, is not necessary to the purposes of this paper. The above remarks, in fact, are intended only as an introduction to a brief discussion of portions of the electrical equipment which is being installed here, and which not only conforms to the rest of the building in the matters of high-grade material and thoroughness of installation but also possesses a number of interesting and important features quite new to office-building construction.

Fig. 1.—Front View of Switchboard.

Not the least interesting part of this electrical installation is the main switchboard, both front and rear views of which are shown in the accompanying figures. This is a slate board of generous proportions, and it has its full complement of meters and switches. Electric service is supplied to the board from the underground mains of Commonwealth Edison Company, the service being from a three-wire direct-current system. The switchboard is divided up into what may be called service panels and feeder panels, the service panels being those to which the incoming circuits run and the feeder panels those from which the circuits supplying electric current to the various portions of the building radiate. There are three of the service panels. The three are adjacent to each other and they may be seen at the extreme right-hand side in the photograph of the front of the board. To the middle one of these three panels the neutral of the three-wire service is brought, there being two neutral cables. Two sets of cables constitute the outside wires of the circuit, and the positive set runs to the service panel immediately on one side of the neutral panel, while the negatives are carried to that on the other. There are four cables in each set. In other words, there are four positive, four negative and two neutral cables in the service. Moreover, two spare conduits have been provided with a view to adding two other cables if this should become necessary. The size of each incoming cable is 1,500,000 circular mils, and the cables are all of the lead and paper-covered type.

A rather unique feature of the service under consideration is the provision for taking care of overloads and insuring freedom from interruptions. Each of the incoming cables terminates in a single-pole switch, which switches may be seen in the photograph of the front of the switchboard. The number of cables in service can therefore be adapted to the load. Also, in case a ground should develop on a given cable, or, for that matter, if it should otherwise become defective, it can be cut out of circuit and another one substituted for it by simply opening one of the single-pole switches and closing another one of them. Each cable is fused both at the switchboard and at the substation, and so a ground on one of them will only cause its own fuse to blow; whereas if there were a number of cables in multiple attached permanently together at the ends without individual fuses, as is frequently the case in circuits for delivering large amounts of power, a bad fault in one conductor might put the circuit entirely out of commission until the fault could be located and repaired. It is interesting to note also in this connection that, in the case of the installation under consideration, the arrangement is such that power may be supplied to the building from either of two substations in this neighborhood.

As may be seen from the photograph already referred to, the switchboard panels to which the service circuits run are provided with two ammeters and

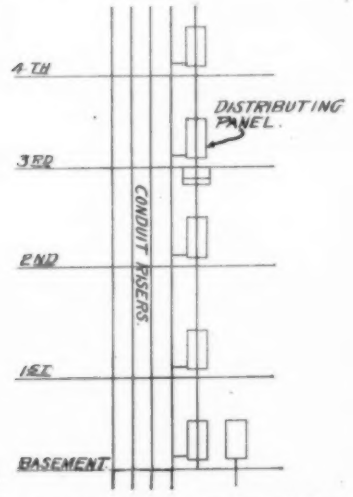


Fig. 2.—Section of a Portion of One of the Four Wire Shafts.

six integrating wattmeters. There is also the necessary number of demand indicators. The wattmeters are arranged to measure separately the total energy used by the tenants of the building; total miscellaneous energy, which is used in lighting the halls and for similar purposes; and the energy employed in operating the elevators—of which there are sixteen, each driven by a 35-horsepower shunt motor. The two ammeters, each of which has a maximum reading of 6,000 amperes, were installed to make it convenient to check up the power consumption whenever it may be desirable to do so.

The feeder panels of the main switchboard are designed to supply three-wire service to the various distributing panels throughout the building for lighting, while two-wire supply is fur-

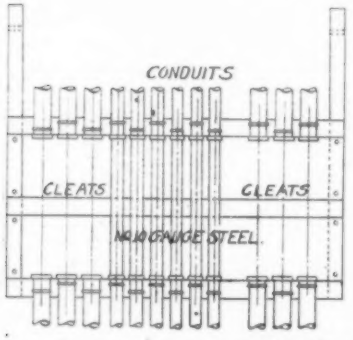


Fig. 3.—Front View of Conduit-Supporting Rack.

nished for the elevators. The motor voltage is 230, and that of the lighting circuits 115.

The photograph of the rear of the switchboard gives a fairly good idea of the large number of circuits and also of the construction methods employed in wiring the board. Though there are not so many leaving the board itself, to be sure, the total number of circuits in the building when the wiring is all done will be 2,600. In the case of all conductors of size No. 6 and larger, conductors having a varnished cambric insulation is employed instead of the usual rubber-covered wire. There are very few buildings in which this type of conductor, it may be added, is used in the wiring.

A further interesting feature of the switchboard is the fact that on the

Fig. 4.—Rear View of Main Switchboard.

feeder circuits the conduits are run, as a rule, much closer to the busbars than is customary. Although it would appear from one of the photographs that there was a rather excessive use of flexible fibre tubing, the fact is that most of the circuits are protected with rigid metal conduit to points very near the busbars themselves. Approaching the switchboard from the rooms above, the pipes enter the large metal pull-box seen above the board, and from the lower side of this box shorter conduits run to convenient terminal points on the back of the switchboard frame.

The switchboard is located in a basement room built especially for the purpose. From the several feeder panels of the main board the circuits run to four vertical wire shafts. Each of these four shafts extends from the basement to the attic and is of ample size to accommodate the vertical risers of all the electric wiring. On every floor there is in each shaft a distributing and metering panelboard, there being thus four points on each floor from which the current is distributed to the various offices and hallways on that floor. A section of a portion of one of the shafts which contain the vertical risers is shown herewith and the positions of the distributing boards is indicated.

The boards are installed in one-eighth-inch sheet-metal cabinets and are of the Ames type. The total depth of the cabinet is 20 inches. From the front of the inclosure to the slate panel itself is eight inches. In addition to the front door, there is a side door, the opening of which makes the wiring on the back of the board accessible. There are "knockouts" for the circuits entering and leaving the cabinets and also for the meter-loop conduit. It is to be noted here that this use of conduit on meter loops is a very fortunate improvement over wiring practice in vogue in some localities not long ago.

The time is not long past when meter loops like this were very frequently run without even a covering of flexible tubing for the wires.

The distributing panels are arranged so that power can be metered to eight parties from each cabinet. In the accompanying photograph of one of the cutout cabinets wattmeters may be seen already installed on either side of the cabinet, and there is a board just above the cabinet on which other meters will be placed as other tenants in this quarter of the building and on this particular floor apply for electric service.

The panelboards are so designed that the circuits, when eight are run from one board, may each be fused for 30 amperes, with cartridge fuses, or the board may be used for two-party service, in which case 60-ampere fuses may be employed.

The details of the meter-connecting block used on the meter loops are brought out in Fig. 7. This block was designed to meet the requirements of a recent ordinance of the department of electricity of the city of Chicago, which specifies that all meter loops on a conduit installation must be inclosed in conduit to meter-connecting block. This block is 1.25 by 2 by 4 inches in dimensions and is fitted into one side of an outlet box so designed that the wires to the meter may be brought out through porcelain bushings or through holes in a block of porcelain. It will be observed that the meter wires from the cabinet are connected to one side of the block and the wires to the meter itself run from the other side. Whenever a meter is removed the short extensions are disconnected altogether from the block, thus eliminating the danger which may arise when live metal loops are left in taking a meter down. Moreover, the use of the block insures a permanently neat appearance for the job regardless of the removal of meters. As neat as it is, however, this block is not altogether satisfactory, the trouble being that there is not sufficient working space on the meter side of the terminal connecting points. The outlet box should probably be made longer and the block itself placed in the center of it, thus leaving electricians room to connect the wires on the meter side of the fitting more readily and quickly than is now possible.

Another very interesting feature of the electrical work in the building in question is the method employed in supporting the vertical risers in the electrical distributing system at the necessary points in the vertical wire shafts mentioned in the foregoing notes. As most electrical contractors are well aware, there is a rather prevalent lack of good practice in supporting circuits of this kind. The common plan of fastening the risers to walls by whatever means may suggest themselves first may do where the size of the conductor or of the conduit, as the case may be, is inconsiderable; but for heavier work it is quite liable to prove very unsatisfactory. In order to overcome difficulties of the kind suggested here, the contractor who is installing the electrical work in this building adopted the plan indicated in some of the accompanying figures. Fig. 8 is a drawing of one of the iron racks employed in supporting the risers. In the left-hand side of the figure the reader is supposed to view the rack from the front, while in the right-hand side there is a sectional view as the rack would appear to an observer looking along the I-beam to which the rack is hung. Fig. 3 is a front view of the rack with the conduit risers which it supports in place. The rack is drilled as shown in Fig. 8 and the pipes secured to it with U-bolts.

It will be recalled that the National Electrical Code requires the conductors in the vertical risers of a conduit system to be thoroughly supported at points separated from each other by distances of from 35 to 100 feet, depending on the size of the conductor.

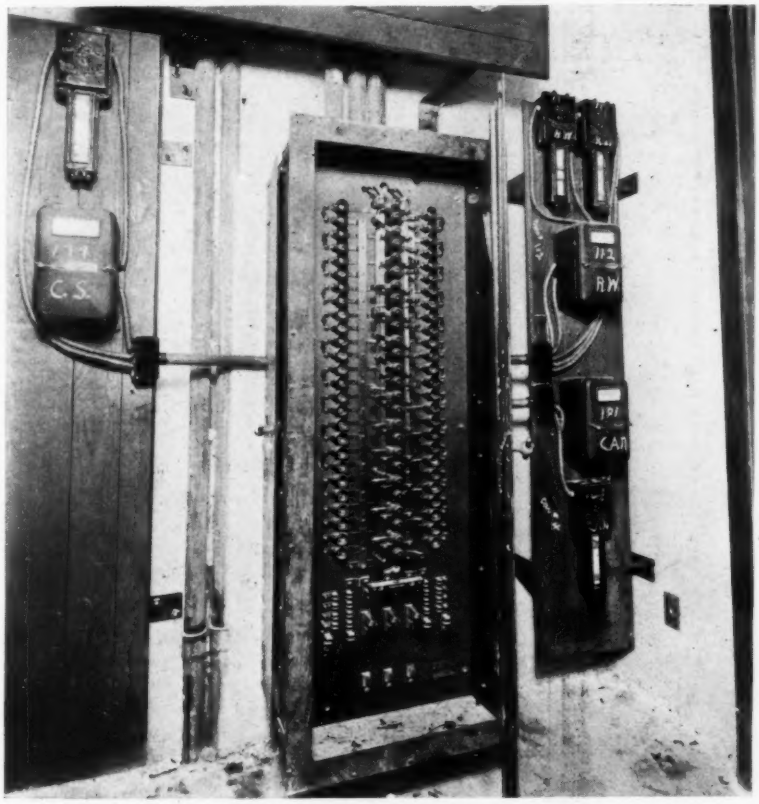


Fig. 5.—Photograph of Cutout Cabinet, Showing Meter Loops.

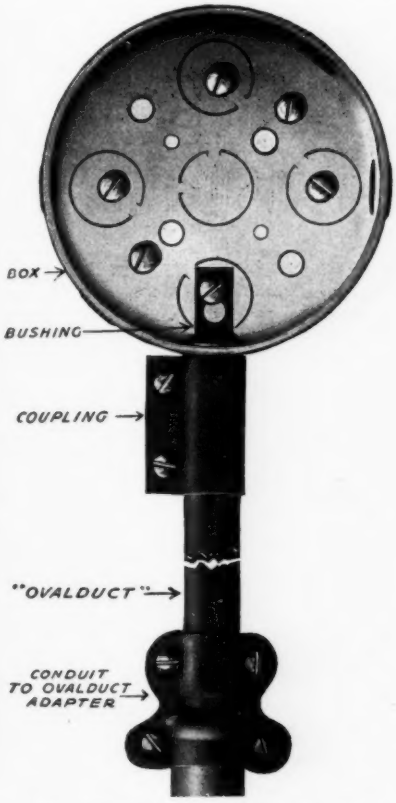


Fig. 6.—Fittings for Oval Conduit.

The method of supporting conduit under consideration also provides a convenient means for anchoring the conductors themselves at the requisite intervals. A horizontal piece of iron such as the one marked "cleats" in Fig. 3 is provided where the wires must be supported and the conductors fastened here with single-wire cleats of

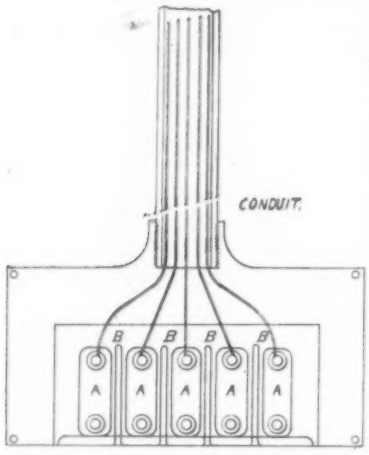


Fig. 7.—Details of Meter-Connecting Block.

a heavy, durable type. Thus the frames provide a substantial and permanent support for the conduits and the conductors too.

In designing the wiring of a large office building it is generally impossible to locate the ceiling outlets so that they will meet all the subsequent requirements in lighting the various rooms, without revisions or changes. It is nearly always the case that even after the building is completed and the electrical work as originally designed all finished many extension circuits must be run and new outlets added. The running of these extension circuits in a satisfactory manner has often proved a difficult matter, it being understood, of course, that concealed conduit work is usually employed in wiring the modern office building. If it be attempted to use rigid conduit in adding the new outlets, the chances are that it will be necessary to channel the ceiling in such a way as to weaken the tiling permanently and leave the job in bad shape from the standpoint of the strength of the ceiling and that of the floor above it. In order to avoid this sort of thing armored cable—known to wiremen as "BX" cable—has sometimes been installed in grooves in the plaster when it was desired to provide additional outlets. Another method consists in running twin-wire lead-covered cables in shallow grooves in the surface of the ceiling. In either of these two cases the grooves are filled with plaster, of course, after the conductors are in place. Aside from the fact that BX cable was found to be too large for work of this kind, the experience of electrical inspectors in Chicago was that both it and the lead-covered duplex, when used in this manner, were subject to numerous grounds which could be freed from the system only by burning them free, which process is obviously a dangerous way of clearing an interior lighting circuit of grounds.

The conditions enumerated above have led to the adoption in Chicago of a new type of conduit for making revisions and extensions in the wiring of buildings of the kind considered in this paper, this conduit being known as Ovalduct. This is a sherardized conduit made of sixteenth-inch metal, and the cross-section of the tube is elliptical, the shorter diameter being three-eighths and the longer five-eighths of an inch. It seems especially well adapted to making alterations and additions to the conduit work in completed fireproof tile structures where the original wiring has been installed in standard rigid conduit. The tubing, as it is used in Chicago, was designed by Julius Goettsch, electrical engineer for D. H. Burnham & Company, the architects who designed the Insurance Exchange Building.

The use of this oval tubing makes the channeling of the tiling unnecessary. It is laid in a small groove in the plaster and fastened to the tile facing with short tie wires which are fished around the tile through two small holes. The conductors can be readily drawn out of a run of it whenever such a procedure becomes necessary. One of the two photographs reproduced here shows a run of the oval conduit in position before the plastering of the surface wired in was restored; the other is meant to give an idea of the proper fittings for this tubing and the correct use of these. It will be noted that in the picture last referred to the method of conecting the oval conduit with standard rigid conduit is shown.

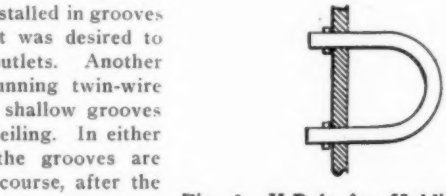


Fig. 9.—U-Bolt for Holding Conduit.

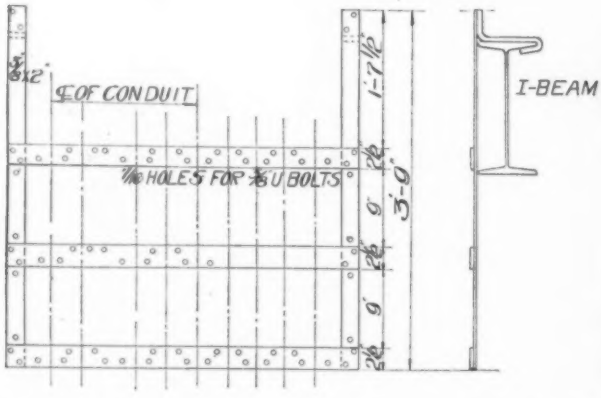


Fig. 8.—Details of Iron Rack for Supporting Conduit.

Fig. 10.—Run of Oval Conduit Before Plaster is Restored on Ceiling.

In concluding this paper the writer wishes to express his appreciation of the courtesy of A. S. Schulman, electrical contractor of Chicago, who installed the electrical work in the building in question, in supplying him with much of the data for the article.

TRANSMISSION POLES.[1]

By W. R. Wheaton.

The increasing cost of power-transmission poles in recent years and the high maintenance charges have turned the attention of power companies to some process to increase the life of the poles. The first cost of the poles has nearly doubled in the past six years, and these two factors have been largely responsible for the interest shown by operating power companies in pole preservation.

In March, 1908, the San Joaquin Light & Power Corporation set a line of Western-yellow-pine poles. The line is about 30 miles long and contains approximately 6,000 poles. These poles were cut at an elevation of about 4,000 feet, and were thoroughly seasoned before treatment. Some of the poles received a brush treatment with carbolineum and with creosote, and the rest were treated in an open tank with creosote, zinc chloride and crude oil. The butt only was treated. Western yellow pine is very susceptible to a preservative treatment. Some of the butts were thoroughly penetrated with creosote and with zinc chloride, the average penetration (at the ground line) being 3 inches. The penetration with crude oil averaged about 1.5 inches. The crude oil used was a heavy oil of asphaltum base supplied from the Kern River fields.

In order to get a comparative life of the wood treated and untreated, stubs of untreated timber were set along the line about a mile apart. The writer inspected this line in June, 1910, at which time it had been set for twenty-seven months. The untreated stubs set along the line were completely rotten. Of the poles brush-treated with carbolineum and creosote the conditions were about the same, a large percentage of each showing signs of decay; 27 per cent of the poles that had a brush treatment with creosote showed signs of decay, and 29 per cent of the poles that had treatment with carbolineum showed decay, while 45 per cent of the poles treated with crude oil were slightly attacked by decay. Of the poles treated with zinc chloride, 28 per cent showed attack by decay. The poles treated with creosote in the open tank (over 50 per cent of the entire line were treated in this way) were all perfectly sound and showed absolutely no signs of decay.

In August, 1911, two of the poles in this line which had received a brush coating of creosote fell over, owing to decay at the butt. During August and September, 1911, the line was gone over and all of the poles which had had a brush treatment of creosote or carbolineum were so badly decayed that they were strapped to a creosote cedar stub.

The value of the experiment is apparent and is enhanced by the fact that the timber used will entirely decay, without treatment, in a year.

The San Joaquin Light & Power Corporation is now treating Western-red-cedar poles at the butts only by the open-tank process. There is no necessity for treating the top, since the top is not subject to decay. With this process the outer ring of sap wood on the cedar poles is filled with creosote, and if the timber is thoroughly seasoned before treatment there is little difficulty in accomplishing this. The penetration varies from one-half to one inch with an absorption of from 7 to 9 pounds per cubic foot. As for the efficiency of the treatment, treated and untreated cedar poles have been set for four years. The creosoted poles are still perfectly sound, while the poles set untreated have decayed through the sap wood and into the heart.

The question has been asked why zinc chloride, copper sulphate or some preservative other than creosote has not been used to cut down the treatment charges. It was found that several poles treated with chloride of zinc were, after the installation of irrigation systems, in the middle of irrigated fields. The zinc was washed out of them, and the poles had to be replaced after a service of two years. The saving in the cost of treatment by the use of a metallic salt would not mean a saving in the end if many such replacements took place. A 50-foot creosoted pole placed in the line means an investment of about $25. The use of chloride of zinc would cut this cost to $24.25 and the saving is too small to be considered against the possibility of the loss of the preservative by leeching out after one or two years.

1 Abstract of a paper read at the annual meeting of the Wood Preservers' Association, Chicago, Ill., January 16-18, 1912.

Electrical Committee of the National Fire Protection Association.

The names of the members of the Electrical Committee of the National Fire Protection Association given in our issue of March 9 was incomplete. The complete list of the membership of this committee is as follows: F. E. Cabot, chairman, Boston, Mass.; Ralph Sweetland, secretary, Boston, Mass.; Farley Osgood, Martin Schreiber, Franklin Overbagh, E. McCleary, J. E. Cole, W. H. Blood, Jr., James Bennett, W. S. Boyd, G. E. Bruen, Washington Devereux, J. C. Forsyth, C. M. Goddard, C. H. Hill, H. O. Lacount, A. M. Paddon, Dana Pierce, A. M. Schoen, R. P. Strong, V. H. Tousley and H. S. Wynkoop.

The high-powered Navy station now building at Arlington, outside of Washington, which will be in operation next July, uses a power of 100 kilowatts and has a range of 3,000 miles with a wave-length of 4,000 meters.

Among the Contractors.

The Sanborn Electric Company, of Indianapolis, Ind., has been awarded the contract for installing the lighting and ventilating system in the new school building at South Bend.

The Winters' Electrical Company has been awarded the contract for the wiring of the new Indiana school building, Toledo, O., which will be erected this summer. The contract was secured from a field of enthusiastic bidders.

The contract for lamps and electric-lighting devices for the fiesta to be held in San Antonio, Tex., April 15 to 20, has been awarded Martin Wright. The contract calls for over 8,000 electric lamps, which will be used to illuminate the streets and buildings.

The American Electric Company, electrical engineers and contractors, which some time ago took over the business of the Brown-Starr Company, of Kansas City, Kans., is a progressive company that is doing a large share of the electrical work in that town. The company was organized by E. C. Eager and F. E. Williams, both of whom were members of the 1908 class of the Bliss School of electricity, and to the personality of these gentlemen the success of their business is largely due.

James Beaman, of the Pratt Manufacturing Company, Joliet, Ill., has designed an interesting induction apparatus for display in the show window of the Public Service Commission in that city. It consists of an aluminum pan resting upon a sheet of glass which is supported by four inverted glasses. A set of primary coils is placed in the basement directly below but out of sight, and the rotation of the pan results from the secondary currents induced in it. A small pivot projecting into a hole in the glass plate keeps the pan centered.

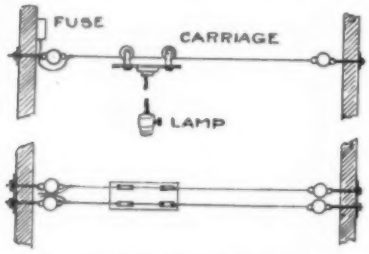
Edwin M. Raetz, who has been a partner in the business of the Kennedy Electric Company, Rochester, Minn., for the last five years, has purchased the interest of William Kennedy and will continue the business under the old name, which has been established for 25 years. Mr. Raetz has been intimately connected wih the electrical contracting business for 13 years, and has had a varied experience as wireman and foreman. The company is at present making a specialty of equipping farm residences and buildings with electric lighting plants. Many acetylene plants have been replaced, following destructive explosions.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Novel Way of Obtaining Portable Light.

In front of the terminal and heat-coil board in a telephone exchange, I recently saw a lighting device which struck me with its ingenuity and utility. It consisted of two trolleys of No. 10 hard-drawn copper wire suspended between the two walls of the room, and in front of the connection board by eye-bolts and strain-insulators. At one end the threaded end of the eye-bolt extended through about three or four inches to allow for adjusting the tension of the trolleys. The current is fed to these wires through a double-pole snap switch and three-ampere fuse. The traveler is made of a piece of 3/16 by 4 by 6-inch fiber or asbestos-wood, and four brass ceiling pulleys



Lamp Carriage and Circuit.

with one-inch wheels. A common drop is fastened to this piece of fibre, and connected to the pulleys. The space served by this single light is about twenty five or thirty feet long, and to get the same illuminating results would require at least six drops or a long extension and innumerable hooks and fastenings to hang the socket on.

The Underwriters would not hasten to approve this device; but for this and many other locations it would be perfectly safe, and for appearance, simplicity and convenience I have seen nothing to surpass it. The sketch shows side and top views of the device. Care must be taken to have the wires level; otherwise the appearance would not be good, and it would also be difficult to keep the car in place.

Roy W. Eves.

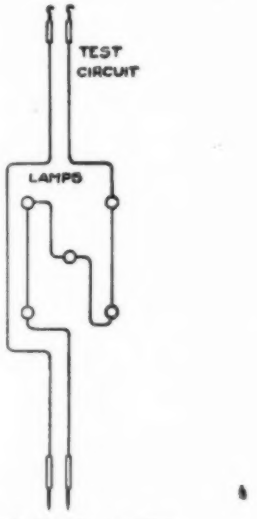
Fishing Wires in Partitions.

In fishing wires up a partition I sometimes had trouble in getting the loom through a five-eighths hole in the plate at the top. Now when I encounter this difficulty I overcome it by splitting the loom just a little on the end and wrapping it tightly about the conductor with either a cord or a small bare wire. This gives the loom such a taper as to make it comparatively easy to pass it through the holes.

J. D. Craig.

A Convenient Testing Circuit.

The arrangement illustrated in the accompanying sketch provides a cheap and often very convenient set for testing electrical apparatus for grounds, short-circuits and other similar disorders. Insulating tubes are used at the ends of the wires to protect the operator. The contact-points are made of copper wire, as are also the hooks for putting the conductors in circuit. It is possible to adjust the testing de-



Circuit Ready for Use.

vice to different voltages by using different lamps, of course. The diagram indicates the arrangement of a set in which I use five 110-volt lamps for testing railway motors.

A. L. Utz.

Locating Trouble Caused by Armature Striking Pole Pieces.

A motor was brought into my shop several weeks ago because of a clicking sound which could not be located.

From all appearances the trouble was caused by the armature striking the pole pieces. I removed and replaced the armature several times, testing for worn bearings, sprung armature shaft, or loose band wires, and at the same time carefully examining the surface of the armature and field pieces for points of friction, but none of these defects could be found. The striking was so very slight that it was possible to hear it only while the machine was under its own power. I finally overcame this difficulty in the following manner: I removed the armature, took a piece of school crayon with which I covered the entire surface of the pole pieces, carefully replaced the armature and turned on the current for a minute; when I stopped the motor I at once saw a black streak or line across the surface of both pole pieces and a small white point, covered with crayon, on the armature. The trouble proved to be a projecting point of one of the laminations which had worked loose.

I believe this is a quick and practical way of locating slight points of armature friction which can not be detected with the eye.

W. A. Hines.

Taking up Slack in Exposed Wires.

After having tried various ways of tightening up a strip of wire on a ceiling, all of which were more or less unsatisfactory, I finally adopted the method described below, which I have used ever since and which I find to be quite convenient. Having made one end of a given run of wire fast with a cleat, or even with two cleats if necessary, I secure the other end by a cleat; also drawing up the wire as tightly as possible with my hands. Then about two feet from this last cleat another is placed but not tightened up. I next take a short piece of board and place it flat between the last two cleats. Then by turning the board edgewise the whole run of wire may be drawn as tight as is desired, after which the loose

Relative Positions of Cleats and Board.

cleat is secured to the ceiling and all the other cleats along the line installed. This plan is applicable also to exposed knob wiring and makes it very easy to install the knobs in a perfectly straight line. If when a circuit has been installed the wires do not seem to be tight enough, the slack may be easily taken up by going over the job a second time with the board in the manner indicated. The method of procedure is indicated in the accompanying figure.

H. Piccard.

An unusual sight recently witnessed at Cheyenne Wells, Colo., was the seeding of a large acreage of land with winter wheat, the seeding being done at night. Light was furnished by electric lamps.

National Electrical Inspectors' Association

THOMAS HENRY DAY, President. 59 Deerfield St., Hartford, Conn.
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Concerning Size of the Neutral.

Question 166. Is it permissible to reduce the size of the neutral on say an Edison substation as follows? The panelboard carries a balanced three-wire distribution for lighting and 220-volt two-wire power work. Service switch, master meter and individual meters on the several branch distribution mains are provided.

a. May the neutral from the service switch to the master meter and panelboard be smaller than the outside wires?

b. After leaving this substation with a three-wire distribution branch main, may its neutral be run smaller than the outside wires?

Answer 8. In reply to questions both *a* and *b*, I should say that the neutral should be of the same size as either of the outside wires; for in the event of the blowing of one of the fuses in the outside leads the neutral would be required to carry the same current as either of the outside lines.

Answer 9. The neutral of a three-wire Edison system carries normally only the difference between the currents in the two outside wires, which difference may vary from zero in the case of a perfectly balanced system to an amount equal to that of the entire load on either outside wire. Even in the case of a balanced system, such as this question contemplates, the failure of a fuse or other connection on either outside main throws upon the neutral the full load of the other main. This, with a reduced-size neutral wire, will in turn blow the neutral fuse, killing the entire service.

The question seems to be one of good engineering rather than one coming within the jurisdiction of the electrical inspector. So long as the neutral is provided with the proper fusing or grounding protection as required by the Code, the writer knows of no Code requirement that would be violated by the proposed plan of a reduced neutral.

Fuses for Motor Circuits.

Question 167. Would it be in accordance with the rules to take a 220-volt motor circuit off of a three-wire 110-220-volt feeder that is fused with a three-wire Edison plug cutout, the motor being properly protected with a cartridge fuse cutout; or should the three-wire plug-fuse cutout be changed to a three-wire cartridge-fuse cutout? It is understood that in either case the wires are properly protected as regards the size of fuses.

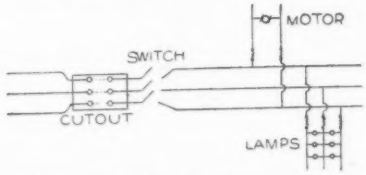


Diagram Illustrating Question 167.

Answer 8. Three-wire plug cutout should be changed to the cartridge type, as the installation of a 220-volt motor upon the two outsides requires this cutout to give protection at a pressure of 220 volts. In the Edison three-wire system, the plug cutout is required to give protection at 110 volts pressure. It appears to be merely a question of choosing fuses of the proper voltage.

Answer 9. Any condition that might result in the blowing of an Edison plug fuse under a 220-volt pressure is to be condemned. While it is conceivable that with a very small cartridge fuse at the motor and a very large plug fuse in the main, the chances of blowing the 125-volt plug are remote, yet such a result is quite possible; and, furthermore, there can be no assurance that such relation between fuse sizes will be maintained. If it becomes necessary to take a 220-volt connection from an existing three-wire 110-220-volt main, any plug cutout in this main should first be removed and replaced with the regular cartridge-type block and fuses.

Secretary's Announcement.

The secretary is glad to announce that the two inspectors whose names follow have recently become members of the Association: F. L. Warner, inspector in the Bureau of Electrical Inspection of New York City, 215 West Twenty-third Street, New York; William J. Murphy, inspector for the city of Edmonton, Alberta, Canada. Additional answers are given here to the questions in the issue of March 2.

Grounding Through Armor of Cable.

Question 168. In a large conduit system with heavy mains, would it be good practice to make the ground connection through the armor of a No. 14 (BX) cable? Would it even be permissible?

Answer 8. The ground for a conduit system should be made upon the largest conduit in the system, or at sufficient points throughout the system that the proper ground-carrying capacity may be obtained, equivalent to the largest carrying capacity of the largest-sized mains. This way of grounding the No. 14 BX cable will not afford the proper carrying capacity for the system and the conductivity of the BX cable is not equal to that of conduit of the same size.

Answer 9. No. This practice should not be allowed.

Code Requirements and Motor Starters.

Question 169. What rule in the Code requires a rheostat to be used in connection with a direct-current motor, or an auto-starter with an alternating-current motor? If none, how can an inspector require one to be used?

Answer 8. No rule in the Code requires the use of starting rheostats on direct-current motors, as the rheostat is considered a part of the motor and the starting of the latter without some auxiliary resistance would be impracticable. When the motor is idle there is no counter electromotive force and hence the throwing of the machine on the line without resistance in the armature circuit is practically a short-circuit and may injure the motor seriously.

Answer 9. There is, I think, no rule in the National Code under which

an electrical inspector can require the installation of a motor-starting rheostat or an autostarter. This also seems to be a matter rather of good engineering practice; and in the absence of any authoritative classification and rating of motors, as regards maximum current allowable in starting, the inspector whose authority is co-extensive with the Code would not be in a position to enforce such requirement.

Bill Regulating Wireless.

A bill has been introduced into the United States Senate by Senator Smith of Michigan, to regulate radio communication. This bill gives authority to the Interstate Commerce Commission to prescribe regulations with respect to the wave lengths and character of radiation employed by all stations in this country and vessels of the United States. No station shall be operated except by a person licensed by the Interstate Commerce Commission. All owners of stations are required to file statements with the Commission and receive a number or designation by which such station shall be known and it shall be used in signaling. Penalties are prescribed for failing to file statements; for operating without a license; for interfering with distress signals; for violating the regulations; etc.

Public Service Commissions

WISCONSIN.

An order has been issued by the Commission in the matter of the complaint against the rules, regulations and service of the Southern Wisconsin Railway Company in the city of Madison. The order abolishes or amends those of the company's rules which were not considered to be in the best interests of efficient service. The rule prohibiting the use of the front platform and door was ordered discontinued and henceforth the public may use the front vestibule for the purpose of exit. Its use for purposes of entrance is left optional with the company. The order also provides for a faster running schedule to go into effect immediately and a further reduction in running time to go into effect not later than July 1, 1912. The company contended at the hearing that a faster schedule had been attempted in the past, but that the increased cost of repairs and the crippling of the service through the numerous breakdowns was occasioned by the faster running time had caused a return to the slower schedule. The Commission, however, did not consider that the increased wear and tear on the equipment could be urged as a valid objection to the rendering of adequate service. Further orders will be issued upon the completion of the engineers' investigations.

NEW YORK.

The Public Service Commission approved, with certain modifications, the offer of the Interborough Rapid Transit Company for the construction and operation of subways as finally submitted by the company. The approval of the commission has been ordered to be sent to the Board of Estimate. The main features of this offer were stated in the issue of March 9.

The New York Telephone Company announces a revised and more liberal schedule of commissions to its public telephone agents on receipts from slot machine telephones. The present rate of commission is 10 per cent. The new schedule, which goes into effect March 15, is on a sliding scale, ranging from 10 per cent to 20 per cent, depending upon the amount of daily receipts, those stores doing a large amount of business getting the higher rates of commission. The company states that the increase in commissions to be paid will amount to about $115,000 a year over that paid on the present scale. The new schedule will be made effective throughout the entire territory of the New York Telephone Company, and will apply not only to the druggists' telephones, but to all classes of public telephone agents whose stations are equipped with the multi-coin box telephone.

INTERSTATE COMMERCE COMMISSION.

The Western Union Telegraph Company filed its answer on March 15 to the complaint of the Postal Telegraph-Cable Company. In a general way it is a denial of the charge that the Western Union discriminates against the Postal. The Western Union contends that, in receiving a message from the Postal originating at a point where both companies have a receiving office and going to an exclusive Western Union destination the three extra words indicating the transfer point are necessary for the protection of itself, the sender, and the receiver. To illustrate the point, when the Postal receives a message in Baltimore destined to a point in Virginia where the Postal has no office, the Western receives it at Washington and writes in after the date line Baltimore the words "via Washington, D. C." If it was a ten-word message on which the Postal received the ten-word rate when it is turned over to the Western, the latter company charges the Postal the full ten-word rate plus the charge for the three additional words indicating the transfer point. The answer filed by the Western Union admits that this is the practice in all parts of the country except New York state. The New York authorities have forbidden a charge for the words indicating the transfer point. The respondent company, in its answer, remarks that it maintains about 1,700,000 miles of wire, 215,000 miles of poles, and about 25,000 offices, while the Postal has only 300,000 miles of wire and about 3,500 offices. These Postal offices are in the larger cities, which furnish approximately 80 per cent of the telegraph business of the United States. The Western states that 21,500 of its offices earn only $2 per month, or less; that the Postal bears none of the expense of maintaining the 1,400,000 miles of wire connecting offices in places where the business is unremunerative, but necessary in order that universal service may be given. The respondent company contends that in the enforcement of its rule requiring the three extra words indicating the transfer point, it treats the Postal as it does every other telegraph company under like conditions and circumstances. It makes its denial as broad and sweeping as possible, arguing that its failure to require cable companies to pay a charge on words indicating the transfer point is not a comparable case, because every telegraph company and every receiver of a cable message knows that the cable companies terminate in New York City and there is no necessity for indicating the transfer point. It further contends that the rule against which the Postal complains is reasonable and fair and it makes the charges for such additional words only because the complainant insists upon delivering messages at other than regular transfer places.

THE NORTHWESTERN ELECTRICAL EXPOSITION.

Third Annual Show Held in Minneapolis, March 16-23, 1912.

The preliminary reports concerning the third annual Northwestern Electrical Exposition sent out by Manager Robert W. Clark were fully justified by the splendid exposition which opened in Minneapolis, Minn., on March 16. A number of special features arranged for this affair, together with three important conventions scheduled to be held during the show week, created an unusual amount of interest, and the attendance, the first few days, far exceeded expectations.

The decorative features were similar to those of the 1911 show, with numerous supplementing features. The sky effect, which created such admiration last year, was repeated.

Each day of the show was named in honor of a great electrical inventor, the schedule for the week being, Saturday, Edison Day; Monday, Tesla Day; Tuesday, Westinghouse Day; Wednesday, Bell Day; Thursday, Steinmetz Day; Friday, Brush Day; and Saturday, Thomson Day. The show was officially opened on Saturday by Thomas A. Edison, who, by pressing a button in his laboratory at Orange, started the wheels of the industrial exhibitions. He also sent a telegram to the Governor of Minnesota, complimenting the State on holding such an affair. An interesting feature in connection with this telegram was his prophecy concerning electricity in the future. It stated, in part, that electricity will be the sole agent for the moring of all vehicles in cities, will displace the steam locomotive and perform nearly every service on the farm and in the home, revolutionize the metallurgical and chemical industries and extract nitrogen from the air for soil fertilization. He also stated that a twin sister to this exhibition devoted to scientific farmng should be held annually in the great Northwest to illustrate methods for doubling the crops by the mere exercise of the intellect, bring about great and permanent prosperity and hasten the introduction of scientific apparatus, a large part of which is sure to be electrical. On succeeding days telegrams were received from the men for whom each day was named.

The Minneapolis General Electric Company maintained eleven booths and had, by far, the most extensive exhibit at the show. In one corner of the Armory was shown a typical miniature eight-room cottage, electrically lighted, and containing models of various electrical domestic appliances. About the grounds, surrounding this cottage, numerous electrical vehicles could be seen in operation, and the scenic effect was enhanced by a miniature system of ornamental street lighting, an exact model of the Minneapolis lighting system. In another booth was shown a battery truck crane, while a complete assortment of domestic and commercial heating and cooking appliances was shown in the remaining booths.

The exhibits of High School students attracted considerable attention as prizes were offered for the best electrical device constructed by students. Among other exhibitors were the following:

American Ironing Machine Company, Chicago, had on exhibition a 37-inch electrically heated ironer, driven by direct-connected motor, and a 42-inch gas-heated ironer, belt-driven by a motor. The company was represented by H. G. Grosse.

American Steel & Wire Company, Chicago, displayed "Americore" rubber-covered wire, which is the new Code wire approved by the Underwriters; and samples of pure Para rubber in crude form as it is shipped from South America. The company was represented by C. S. Knight, O. M. Clifford and A. S. Dumont.

Anderson Electric Car Company, Detroit, Michigan, had on exhibition a four-passenger coupe and a 2,000-pound delivery wagon.

Baker Ice Machine Company, Omaha, Neb., showed in operation, electrically driven refrigerating machines. The company was represented by B. K. Postlethwaite.

Baker Motor Vehicle Company exhibited its latest model five-passenger Colonial brougham. Th company was represented by A. H. C. Dalley and Milton L. Hughes.

Bryan-Marsh Company, Cleveland, Ohio, made a display of drawn-wire Mazda lamps of all sizes. The company was represented by Joseph Barnard and F. F. Frisby.

Columbus Buggy Company, Columbus, Ohio, had on exhibition its model 1220, shaft-driven electric coupe. The company was represented by L. W. Pitcher.

Crane Company, Chicago, Ill., exhibited power-plant specialties, automatic double-acting non-return and emergency cutout valves, and Crane-tilt direct-return and non-return traps; also a complete line of high-pressure steel and brass valves. The company was represented by Thomas H. Ireland.

Duncan Electric Manufacturing Company, Lafayette, Ind., showed a line of type M alternating-current watt-hour meters, also one of its new astatic shunted-type direct-current meters and a line of direct-current switchboard and portable meters. The exhibit was in charge of John A. Clark.

Edison Storage Battery Company, Orange, N. J., displayed its various types of cells ranging from the small type B-2, having a rated capacity of 40 ampere-hours, to the largest, type A-12, having a rated capacity of 450 ampere-hours. There were also on exhibition the small automobile ignition and lighting batteries, and a complete assortment of plates. M. R. Hutchinson, C. B. Frazer, F. V. McGinness and E. R. Alexander were in attendance.

Electrical Engineering Company, Minneapolis, Minn., exhibited American heating apparatus; Bell single-phase motors; Deitz washing machines; Adams-Bagnall fans; Bryan-Marsh lamps; Holophane shades; Moloney transformers; Paiste wiring supplies; Crouse-Hinds condulets and fittings; Klein's tools, and Union fuses. The company was represented by M. W. E. Stephenson, P. W. Forsberg, H. Richardson, H. Nebelthan and Mr. Stoddard.

Electric Machinery Company, Minneapolis, Minn., had on exhibition an engine-type generator frame; a belted-type generator with direct-connected exciter and a complete line of direct-current machinery. A feature of this exhibit was a miniature motor said to be the smallest ever constructed. The company was represented by Truman Hibbard.

Electric Storage Battery Company, Philadelphia, Pa., displayed a various assortment of plates including the Chloride type for central-station service and the Iron-clad and standard Exide for vehicle use. A feature of the exhibit was a battery of 58 cells in actual operation "floating" on the Armory power circuit, being used to regulate the voltage fluctuations. due to the turning on and off of various motors in the different exhibits. The exhibit was in charge of T. A. Cressey, of the Chicago office, assisted by C. Seifert, of the Exide Inspection Department.

Fairbanks, Morse & Company, Chicago, showed Fairbanks-Morse generators and motors and the standard 30-volt farm-lighting generator with belted gasoline engine and switchboard. The company was represented by R. M. Davies.

Fawkes Auto Company displayed a model "K" Ohio electric brougham. The company was represented by W. S. Crammer.

Federal Sign System (Electric), Chicago, exhibited electric signs; Federal power tables; vacuum cleaners; washing machines and attachments. The company was represented by C. C. Thwing, J. G. Harvey, J. M. Delaney, M. Kuhn, M. A. Allison, W. P. Goodyear, E. L. Simmon, H. E. Wilkie and F. Levan.

Flour City Ornamental Iron Works, Minneapolis, Minn., exhibited its standard ornamental posts for street lighting and samples of ornamental iron and bronze work recently designed for the United States Government. The company was represented by William Burns, A. H. Hillman and William Tetzlaff.

William A. French & Company, Minneapolis, Minn., showed a number of electroliers, portable lamps and wall brackets. The company was represented by W. A. French.

Fries-Patterson Company, Minneapolis, Minn., exhibited Santo vacuum cleaners, Judd electric washing machines, Simplex home ironing machines and Simplex heating devices. The company was represented by E. G. Patterson and M. L. Rouzer.

The General Vehicle Company, Long Island City, N. Y., had on exhibition a 2,000-pound delivery wagon, equipped with a 60-cell Edison battery, as used by the Minneapolis General Electric Company. The company was represented by A. J. Brechtel.

The General Electric Company,

Schenectady, N. Y., had on display a complete line of the most modern electrically operated household devices. There was also shown a line of small motors, transformers and flaming arc lamps. The feature of the exhibit was the luminous arc lamp for ornamental street lighting, which is a new development and is being rapidly installed in a number of cities. The company was represented by N. F. Smith, G. G. Fletcher, George Fiske, D. D. Beeker and H. S. Hyde.

Hackney Ventilating Company, St. Paul, Minn., had on exhibition working models of its electrically operated ventilating system for residences and commercial institutions. The company was represented by D. B. Miner and M. C. Elliott.

W. O. Hartwig Electric Company, Minneapolis, Minn., had a very attractive booth showing the effects that can be obtained by various systems of electric lighting. The company was represented by M. J. LaValle.

Haskins Glass Company, Wheeling, W. Va., showed a complete line of Haskins-Lucida glassware and its improved type of Lenticular reflectors. The company was represented by G. H. Lindsay and G. F. Pashley.

Hollis Electric Company, Minneapolis, Minn., showed a line of Century fans and motors, Crocker-Wheeler motors and generators, and Fairbanks-Morse lighting sets. The company was represented by A. C. Rheinhardt, H. H. Rheinhardt, T. W. Findley and H. K. Elmer.

Holophane Company, Newark, Ohio, exhibited a complete line of shades, reflectors and globes. The company was represented by A. W. Hawkins.

Hughes Electric Heating Company, Chicago, exhibited several ranges and hot plates. The company was represented by George W. Hughes.

Hurley Machine Company, Chicago, Ill., had on exhibition its Thor and Red electric washing machines. The company was represented by Mr. Hurley.

Ilg Electric Ventilating Company, Chicago, exhibited a line of ventilating fans and blowers. J. M. Frank was in charge of the exhibit.

Kemp Brothers Auto Company, Minneapolis, Minn., had on exhibition a five-passenger Waverley electric limousine. The company was represented by W. Kemp, Earl Kemp and J. E. Kemp.

Kinetic Engineering Company, Chicago, showed the Kinetic blowers for organs. The company was represented by E. N. Johnson.

R. M. Laird, Minneapolis, Minn., exhibited the Thor electric washing machine, Ilg ventilators, Connecticut Arkless fuses, Hughes electric ranges and Acme electric irons. Also a line of Federal electric specialties. The company was represented by R. M. Laird and J. F. Chellingworth.

Manhattan Electric Supply Company, Chicago, had on exhibition a complete line of supplies including Red Seal dry batteries, heating appliances, vibrators and Mesco automobile horns. The company was represented by A. C. Holland and C. H. Methot.

Minneapolis Gas Fixture Company, Minneapolis, Minn., had on exhibition a complete line of electroliers, portable lamps and bracket lamps. D. E. Branham was in charge of the exhibit.

Minerallac Electric Company, Chicago, displayed for the first time the Maxicator, an instrument for converting the ordinary meter to a maximum indicating and watt-hour meter; and Printometers, both portable and service types. The company also exhibited its new Unity insulator, a combination insulator and pin in one piece; insulating compounds and tape; and cable and conduit hangers. The insulators were shown successfully withstanding, without leakage, a potential of 1,000,000 volts. The company was represented by H. S. Sines and J. G. Mench.

Northwestern Electric Equipment Company, St. Paul, Minn., had on exhibition Paiste taplets, Crouse-Hinds condulets and panels, Sprague and General Electric fans, National Carbon Company batteries, Pacific electric heating devices, Fostoria Mazda lamps, Holophane shades, Condit circuit-breakers, Sprague motors and Premier vacuum cleaners. The company was represented by A. J. Anderson, J. M. Hannaford, Jr., and J. M. Whalen.

Pierson-Wilcox Electric Company, Minneapolis, Minn., had on exhibition a small isolated lighting plant, also General Electric mercury-arc rectifiers and heating appliances. The company was represented by R. N. Pierson, H. E. Wilcox and W. H. Gage.

Pelouze Manufacturing Company, Chicago, exhibited several new designs of chafing dishes, percolators, etc., with self-contained heating elements. The company also exhibited a complete line of irons, cooking utensils and traveling sets. The company was represented by Albert A. Gaurdia.

Simplex Electric Heating Company, Chicago, showed a complete line of electric chafing dishes, percolators, toasters, heating pads, etc. A feature of this exhibit was a glass-sided oven in which marshmallows were toasted. The company was represented by E. R. Jacobs and W. C. Booth.

The Sterling Electric Company, Minneapolis, showed Rochester heating appliances, Kimble variable-speed motors, Betts sign flashers, Royal vibrators and vacuum cleaners.

Valentine-Clark Company, Minneapolis, Minn., showed samples of cedar poles, butt treated in the company's open-tank plant located in Minneapolis. The company was represented by L. A. Furlong and E. L. Clark.

Wagner Electric Manufacturing Company, St. Louis, Mo., had on exhibition a converter for changing alternating current to direct current for storage-battery charging, moving-picture machine arcs, X-Ray machines, etc., transformers, alternating-current motors and the rectifier for charging ignition and lighting batteries for gasoline cars. A feature of the exhibit was a demonstrating set comprising two Arnold single-phase motors and a new unity-power-factor motor on the same circuit, connected to a switchboard with instruments showing current taken by each motor and a totalizing meter for illustrating the reduction in amperage when the unity motor is cut in. The company was represented by W. R. Patton.

Western Electric Company, Chicago, exhibited interphones, T. T. C. fixtures, indirect-lighting units, Sunbeam lamps, heating devices, vacuum cleaners, washing machines, fans, etc. The company was represented by C. D. Wilkinson and J. M. Dotman.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., had on exhibition a line of small motors, including the general-utility motor, and a line of single-phase and direct-current motors of new design. There was also shown a complete line of heating appliances, including irons, toasters, percolators, chafing dishes, etc., incandescent lamps, arc lamps and fans. The company was represented by Walter Schwedes, W. D. McDonald, C. Darling and the Minneapolis sales force.

Thawing Out North Brother Island.

On March 6 the New York Edison Company received word from C. F. Lacombe, chief engineer of the Department of Water Supply, Gas and Electricity, of New York City, to undertake the startling task of thawing with electric current the six-inch water main under the East River, on which North Brother Island is dependent for its water supply.

For more than a month this pipe had been frozen and the conditions on the island were becoming serious. Although surrounded by water the inhabitants of North Brother Island were facing the prospects of a water famine. In the emergency water carts were pressed into service and taken across, filled with water, on the *Riverside*, the little steamer which plies between the island and the mainland.

Although these measures helped out, they were found to be entirely inadequate for hospital purposes, the island being devoted to a number of departments of the City Hospital. So alarmed were the authorities becoming over the situation that orders were issued from the Department of Health for the removal of a large number of the patients.

Not for 20 years had this pipe frozen up. The last time was in December, 1892, when severe weather came very early. On that occasion, after all attempts to dislodge the ice in the pipe failed, the whole thing was taken up and relaid. This is a long and expensive process, as the East River between North Brother Island and the mainland is 80 feet deep in two places and from 50 to 60 feet deep most of the way across. The pipe rests on the bed of the river. More ideal conditions for freezing a pipe could hardly be found. The water of the river, being salt, will go as low as 28 degrees Fahrenheit without freezing, while the water in the pipe, being fresh, freezes at 32 degrees, unless it is kept in motion. That is just where the trouble came in and caused the freeze-up. First the pipe froze up tight at the North Brother Island end, where it comes out on the beach and is exposed at low tide to the zero temperature of the air. When these few lengths froze,

the water in the rest of the pipe stood still and soon froze solid.

Within just one hour after the New York Edison Company received word from Chief Engineer Lacombe to proceed the work was under way. W. T. Morrison, the engineer in charge of the Bronx District, took command. First a gang of carpenters put up a shack on the shore of the East River at 141st Street, which was turned into a temporary substation. A bank of four 100-kilowatt transformers was installed to step the current, which was taken directly from the company's mains, from 2,000 to 200 volts. A water rheostat was also installed. A cable carried the current to the point where the pipe was severed. The pipe was also severed at the North Brother Island end and the current taken off there and returned to the mainland on the company's cables.

Temporary Transformer Installation.

Water Rheostat.

The men worked all night on the sixth and at 10:15 a. m. on the seventh the current was turned on. At 11:30 it was increased to 800 amperes and 200 volts. Pumps were installed on North Brother Island and a pressure of 80 pounds maintained in the main. These pumps were operated by electricity. During the evening of the seventh the current was increased to 1,000 amperes.

On the eighth another boost was given the current so that it was kept up to an average of 1,300 amperes. Early in the afternoon the hopes of the men took a bound. The cause was a considerable amount of steam which came out of the pipe on the Bronx shore. This was not a slight vapor but real steam. It continued to pour out for some time and seemed a sure indication that the ice was melting.

All that night the current was kept up to 1,300 amperes and on the morning of the ninth it was boosted to 1,500 amperes. The temporary substation was enlarged and two more 100-kilowatt transformers installed, and 400 volts used. On the tenth the current was raised to 1,800 amperes, but on account of the night city load it was dropped back to 1,600 amperes.

On Sunday Mr. Morrison tried an experiment. He had a length of pipe similar to a length of the frozen main packed solid full of ice and closed up tight at both ends. This was let down to the bottom of the river and the same current passed through it as passed through the main. It was taken up after 12 hours and the ice was found to be entirely melted.

On Monday, March 11, the current was again brought up to 1,800 amperes, and in the evening again dropped back to 1,600 amperes.

Success came most unexpectedly at 6:20 a. m. on Tuesday, March 12. Without the slightest warning water started to flow from the mainland end of the pipe. The pumps on North Brother Island, which had been working all night keeping up a pressure of 50 pounds in the pipe, were forcing the water through. Within a short time the flow of water proved that the pipe was entirely thawed out.

Newark Industrial Exposition.

Newark, N. J., is to hold a great industrial exposition under the auspices of the Board of Trade, May 13 to 25, to accelerate the industrial, commercial and educational interests of the city. Displays will be made in the First Regiment Armory and grounds, the building being one of the largest and best adapted to exhibition purposes in the United States.

The committees in charge of the project number three hundred representative citizens of the Newark industrial district, including Chairman Curtis R. Burnett, who is president of the Board of Trade; Thomas A. Edison; Thomas N. McCarter, president of the Public Service Corporation of Newark, and the leaders in many industries.

Code of Professional Conduct of the American Institute of Electrical Engineers.

The Board of Directors of the American Institute of Electrical Engineers, at its meeting on March 8, adopted the following code of principles of professional conduct.

General Principles.

(1) In all of his relations the engineer should be guided by the highest principles of honor.

(2) It is the duty of the engineer to satisfy himself to the best of his ability that the enterprises with which he becomes identified are of legitimate character. If after becoming associated with an enterprise he finds it to be of questionable character, he should sever his connection with it as soon as practicable.

The Engineer's Relations to Client or Employer.

(3) The engineer should consider the protection of a client's or employer's interests his first professional obligation, and therefore should avoid every act contrary to this duty. If any other considerations, such as professional obligations or restrictions, interfere with his meeting the legitimate expectation of a client or employer, the engineer should inform him of the situation.

(4) An engineer can not honorably accept compensation, financial or otherwise, from more than one interested party, without the consent of all parties. The engineer, whether consulting, designing, installing or operating, must not accept commissions, directly or indirectly, from parties dealing with his client or employer.

(5) An engineer called upon to decide on the use of inventions, apparatus, or anything in which he has a financial interest, should make his status in the matter clearly understood before engagement.

(6) An engineer in independent practice may be employed by more than one party, when the interests of the several parties do not conflict, and it should be understood that he is not expected to devote his entire time to the work of one, but is free to carry out other engagements. A consulting engineer permanently retained by a party, should notify others of this affiliation before entering into relations with them, if, in his opinion, the interests might conflict.

(7) An engineer should consider it his duty to make every effort to remedy dangerous defects in apparatus or structures or dangerous conditions of operation, and should bring these to the attention of his client or employer.

Ownership of Engineering Records and Data.

(8) It is desirable that an engineer undertaking for others work in connection with which he may make improvements, inventions, plans, designs, or other records, should enter into an agreement regarding their ownership.

(9) If an engineer uses information which is not common knowledge or public property, but which he obtains from a client or employer, the results in the form of plans, designs, or other records should not be regarded as his property, but the property of his client or employer.

(10) If an engineer uses only his own knowledge, or information which by prior publication, or otherwise, is public property and obtains no engineering data from a client or employer, except performance specifications or routine information; then in the absence of an agreement to the contrary the results in the form of inventions, plans, designs, or other records, should be regarded as the property of the engineer, and the client or employer should be entitled to their use only in the case for which the engineer was retained.

(11) All work and results accomplished by the engineer in the form of inventions, plans, designs, or other records, that are outside of the field of engineering for which a client or employer has retained him, should be regarded as the engineer's property unless there is an agreement to the contrary.

(12) When an engineer or manufacturer builds apparatus from designs supplied to him by a customer, the designs remain the property of the customer and should not be duplicated by the engineer or manufacturer for others without express permission. When the engineer or manufacturer and a customer jointly work out designs and plans or develop inventions a clear understanding should be reached before the beginning of the work regarding the respective rights of ownership in any invention, designs, or matters of similar character, that may result.

(13) Any engineering data or information which an engineer obtains from his client or employer, or which he creates as a result of such information, must be considered confidential by the engineer; and while he is justified in using such data or information in his own practice as forming part of his professional experience, its publication without express permission is improper.

(14) Designs, data, records and notes made by an employee and referring exclusively to his employer's work, should be regarded as his employer's property.

(15) A customer, in buying apparatus, does not acquire any right in its design, but only the use of the apparatus purchased. A client does not acquire any right to the plans made by a consulting engineer except for the specific case for which they were made.

The Engineer's Relations to the Public.

(16) The engineer should endeavor to assist the public to a fair and correct general understanding of engineering matters, to extend the general knowledge of engineering, and to discourage the appearance of untrue, unfair or exaggerated statements on engineering subjects in the press or elsewhere, especially if these statements may lead to, or are made for the purpose of, inducing the public to participate in unworthy enterprises.

(17) Technical discussions and criticisms of engineering subjects should not be conducted in the public press, but before engineering societies, or in the technical press.

(18) It is desirable that first publication concerning inventions or other engineering advances should not be made through the public press, but before engineering societies or through technical publications.

(19) It is unprofessional to give an opinion on a subject without being fully informed as to all the facts relating thereto and as to the purposes for which the information is asked. The opinion should contain a full statement of the conditions under which it applies.

The Engineer's Relations to the Engineering Fraternity.

(20) The engineer should take an interest in and assist his fellow engineers by exchange of general information and experience, by instruction and similar aid, through the engineering societies or by other means. He should endeavor to protect all reputable engineers from misrepresentation.

(21) The engineer should take care that credit for engineering work is attributed to those who, so far as his knowledge of the matter goes, are the real authors of such work.

(22) An engineer in responsible charge of work should not permit non-technical persons to overrule his engineering judgments on purely engineering grounds.

New $8,000,000 Power House.

The contract has been awarded for the steel work for the new 201st Street power house by the Consolidated Gas Company, New York City, acting for its subsidiary, the United Electric Light & Power Company, practically all of whose stocks and bonds it owns. The entire work is to cost about $8,000,000, and is to be finished within two years.

REPORT OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Bell System Includes 6,632,625 Telephone Stations; Total Wire Mileage, 12,932,615; Daily Average Exchange Connections for 1911 over 24,000,000; Gross Earnings for 1911, $179,500,000, an Increase of Nearly $14,000,000 over Preceding Year.

President Theodore N. Vail, of the American Telephone and Telegraph Company, sent out to the stockholders of his company this week the annual report for the year ending December 31, 1911. The report is presented quite fully below, and is of unusual interest because of the many progressive features that have been added by the present administration. The officials of the company are the following gentlemen:

President—Theodore N. Vail.

Vice-presidents—Edward J. Hall, U. N. Bethell, William R. Driver, N. C. Kingsbury, B. E. Sunny, H. B. Thayer, Charles P. Ware.

Treasurer—William R. Driver.

Secretary—Charles Eustis Hubbard.

Comptroller—Charles G. DuBois.

General Counsel—George V. Leverett.

Chief Engineer—John J. Carty.

Directors—Charles W. Amory, Thomas B. Bailey, George F. Baker, Francis Blake, Harry H. Brigham, Alexander Cochrane, T. Jefferson Coolidge, Jr., W. Murray Crane, Henry P. Davison, Rudolph Ellis, Norman W. Harris, Henry L. Higginson, Henry S. Howe, Charles E. Hubbard, Lewis Cass Ledyard, John J. Mitchell, William Lowell Putnam, Sylvanus L. Schoonmaker, Eugene V. R. Thayer, Theodore N. Vail, Frank E. Warner, John I. Waterbury, Moses Williams, Robert Winsor.

The report is dated March 20, 1912, and is as follows:

Subscriber Stations.

At the end of the year the number of stations which constituted our system in the United States was 6,632,625, an increase of 749,906, including 306,403 connecting stations. 2,158,454 of these were operated by local, co-operative and rural independent companies.

The Bell telephone toll lines of the United States now reach 70,000 places, from many of which a telegraph message can be sent. The extent of the system is best realized by comparison with less than 65,000 post offices, 60,000 railroad stations and regular telegraph offices at about 25,000 places.

The total mileage of wire in use for exchange and toll service was 12,932,615 miles, of which 1,290,403 were added during the year. Of the total mileage nearly 11,000,000 miles were exchange wires, and 2,000,000 toll wires. These figures do not include the mileage of wire operated by connecting companies. Of this total wire mileage 6,831,667 is underground, including 411,406 miles of toll wires in underground cables. The most important development is in the Boston-Washington subway, now completed with the exception of drawing the cable into the Providence-New Haven section. This subway will be about 450 miles in length, and contain about 2,100 miles of single duct and 79,000 miles of wire in the first cable.

Including the traffic over the long-distance lines, but not including connecting companies, the daily average of toll connections was about 645,000, and of exchange connections about 23,484,000, as against corresponding figures in 1910 of 602,500 and 21,681,500; the total daily average for 1911 reaching 24,129,000, or at the rate of about 7,770,000,000 per year.

Traffic of the United States and Europe.

Instructive as it would be to compare the traffic of the other two branches of transmission of intelligence—the mail and the telegraph—with the telephone traffic of the world such a comparison would only be speculative on account of the lack of statistical material. There is, however, sufficient statistical information to permit a comparison of the traffic of these three services, both in the United States and in Europe, during the year 1909. The result is as follows:

EUROPE.

Type of message	Number during 1909	Per cent of total Europe
First-class mail matter	15,387,000,000	74.4%
Telegrams	345,000,000	1.7%
Telephone conversations	4,937,000,000	23.9%
Total	20,669,000,000	100.0%

UNITED STATES

Type of message	Number during 1909	Per cent of total U. S.
First-class mail matter	8,793,000,000	40.9%
Telegrams	98,000,000	0.4%
Telephone conversations	12,617,000,000	58.7%
Total	21,508,000,000	100.0%

In other words, although Europe has about three and a half times the telegraph traffic of the United States, and nearly twice the first-class mail traffic, it has only one-third the telephone traffic of the United States.

The use of the telegraph in Europe was about two per cent of the mails, while in the United States it was but 1.2 per cent, the greater efficiency and distribution of the telephone causing the difference.

The amount added to plant and real estate by all the companies, excluding connecting companies, constituting our system in the United States during the year 1911 was $55,660,738, distributed as follows:

Real Estate	$ 3,411,992
Equipment	18,282,765
Exchange Lines	20,548,080
Toll Lines	11,624,173
Construction Work in Progress	1,793,728
	$55,660,738

The amounts added in twelve years have been as follows:

1900	$31,619,100	1906	$79,336,900
1901	31,005,400	1907	52,921,400
1902	37,336,500	1908	26,637,200
1903	35,368,700	1909	28,700,100
1904	33,436,700	1910	53,582,800
1905	50,780,900	1911	55,660,700

making a total for the twelve years of $516,416,400.

Construction for the Current Year.

Estimates of all the associated operating companies of the American Telephone and Telegraph Company for all new construction requirements in 1912 have been prepared. It is estimated that about $56,000,000 will be required for current additions to plant in 1912, of which amount some $30,000,000 will be provided by the existing and current resources of the companies. All who are responsible for these expenditures are working in complete understanding of these estimates and the limits set on their expenditures.

During the year $58,840,000 was applied out of revenue to maintenance and reconstruction purposes; of this, over $12,000,000 was unexpended for those purposes.

The total provision for maintenance and reconstruction charged against revenue for the last nine years was over $342,300,000.

While commissions and all thorough investigators are agreed that provision must be made out of current revenue for depreciation and future replacement of plant, there seems to be some tendency on the part of others to question any accumulation of reserves.

To make adequate provision for future contingencies it would seem to be plain that in an increasing business there must also be an increasing reserve.

There seems to be a tendency to insist that "betterment" of every character shall be represented by capital issue, and that depreciation reserve should be determined with precision, and that it, and all reserves beyond it represent excessive gross charges; that is, gross charges greater than are necessary for the legitimate purposes of the company.

Reserves are a provision for deterioration and obsolescence of plant beyond that which can be covered by current maintenance and current replacements, and also for deterioration of assets and for fluctuations in gross and net revenue caused by varied business conditions.

There is that obsolescence which comes from revolutionary improvements necessitating wholesale replacements of obsolete apparatus or plant, such as the replacement of overhead systems by underground systems, or such as took place when the present method of operating was introduced. There are those fluctuations in net revenue caused by business depression which cannot be overcome by immediate reduction of fixed charges, overhead expenses or operating costs. There is that constant tendency to increase in wages and cost of material, that tendency to increase in operating expenses and capital charges caused by the constant demand for increased efficiency or service, that demand for extensions, productive and unproductive, and that call for improvements in plant, equipment and apparatus. There is that increase in costs of operating, in greater ratio than the increase in business, peculiar to some branches of the telephone service.

Operating Results for the Year.

The following tables show the business for the year of the Bell Telephone System, including the American Telephone and Telegraph Company and its associated holding and operating companies in the United States, but not including connecting independent or sub-licensee companies, nor the Western Electric Company and Western Union Telegraph Company except as investments in and dividends from those companies are included respectively in assets and revenue. All in-

ter-company duplications are eliminated in making up these tables so that the figures represent the business of the system as a whole in its relations to the public.

BELL TELEPHONE SYSTEM IN UNITED STATES. COMPARISON OF EARNINGS AND EXPENSES, 1910 AND 1911.
(All Duplications, Including Interest, Dividends and other Payments to American Telephone and Telegraph Company by Associated Holdings and Operating Companies, Excluded.)

	1910	1911
Gross earnings....	$165,612,881	$179,477,998
Exp.—operation....	$ 54,235,449	$ 60,085,425
Current Maint..	25,763,082	30,184,522
Depreciation	26,264,927	28,655,832
Taxes	8,355,015	8,965,922
Total Expenses	$114,618,473	$127,891,701
Net earnings.....	$ 50,994,408	$ 51,586,297
Deduct interest....	11,556,864	13,610,860
Balance net profits	$ 39,437,544	$ 37,975,437
Deduct div. paid..	25,160,786	25,966,876
Surplus earnings..	$ 14,276,758	$ 12,008,561

COMBINED BALANCE SHEETS, 1910 AND 1911.
(Duplications Excluded.)

ASSETS:	Dec. 31, 1910.	Dec. 31, 1911.
Contracts and Licenses	$ 2,943,381	$ 2,943,381
Telephone plant	610,999,964	666,660,702
Supplies, tools, etc.	20,987,551	20,749,568
Receivables	26,077,802	32,916,127
Cash	27,548,933	41,878,140
Stocks and bonds	64,766,089	66,777,231
Total	$753,323,720	$831,925,149
LIABILITIES:		
Capital stock....	$344,645,430	$379,727,832
Funded debts...	224,791,696	241,032,822
Bills payable....	42,566,943	41,198,431
Accounts payable	21,721,125	23,382,438
Total outstanding obligations	$633,725,194	$685,341,523
Surplus and reserves	119,598,526	146,583,626
Total	$753,323,720	$831,925,149

The total capitalization, including inter-company items and duplications, of the companies of the Bell System is $1,186,639,036. Of this $524,679,951 is owned and in the treasury of the companies of the Bell System. The capital stock, bonds and notes payable outstanding in the hands of the public at the close of the year were $662,000,000. If to this be added the current accounts payable $23,400,000, the total outstanding obligations of every kind were $685,400,000, as against which there were liquid assets, cash and current accounts receivable, of $74,800,000, leaving $610,600,000 as the net permanent capital obligations of the whole system outstanding in the hands of the public.

Against these obligations, the companies had actual, tangible property, not including franchises, patents or good will, which cost $754,200,000, an excess of 23 per cent over the obligations.

There has been a steady decrease in revenue per subscriber's station, so that now the average subscriber pays for a higher grade, more comprehensive service, less than half what he paid sixteen years ago for the much less useful service that was then possible.

This reduction in cost of service to the user has made it possible for every one who needs a telephone to have one and to get the great advantage of being within reach of everybody by telephone.

Although there has been a decrease in cost of operation every year till 1910, an increase in 1911 over 1910 is to be noted. This is mostly accounted for by increased operators' wages. This item will increase steadily not only from the general causes which influence wages, but from the fact that each year the growing complexity of telephonic apparatus and equipment, and the demands for improved service, make greater demands on the capacity and efficiency of our employees.

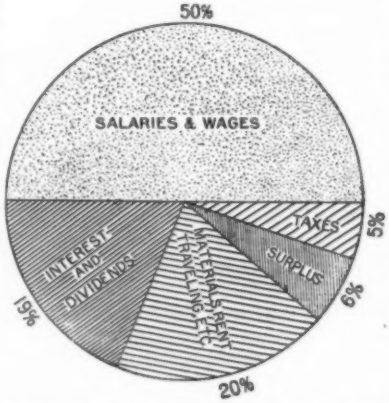
The greatly decreased plant investment per station to which attention has been called in previous annual reports has been still further reduced during the year to $141, notwithstanding the extensive additions to toll lines and the continued increase in the proportion of wires underground. This low cost of plant and a decreasing maintenance cost are only made possible by the central supervision of engineering and manufacturing of the Bell System and by advance construction on a large scale.

Western Electric Company.

The Western Electric Company shows marked improvement in operation during the year. The concentration of its manufacuring operations at Hawthorne, not entirely completed, already shows advantageous results. The gross business for the year was $66,212,000. The foreign business of the company continues favorable. The instruments and apparatus used by the Bell System, manufactured by this company, continue to be the standard the world over.

Disposition of Gross Revenue of Bell System, Year 1911.

The diagram shows the distribution of the gross revenues received from the public. Probably no industry of national scope pays back to the same communities a larger percentage of the revenues that it receives from them. Salaries, wages, taxes, maintenance and other operating expenses are distributed very closely in proportion to the amounts paid for telephone service, while the amount paid in dividends and interest, 19 per cent of the whole, was distributed to over 100,000 individuals distributed over the whole country.



Distribution of Gross Revenues, Bell System for 1911.

Earnings.

The net earnings of the American Telephone and Telegraph Company for the year were $33,301,245.77, an increase of $1,368,031.28 over 1910. The interest charges were $5,567,980.30, and the dividends at the regular rate of 8 per cent were $22,169,449.79. Of the balance, $5,563,815.68, there was carried to reserves $2,800,000.00 and to surplus $2,763,815.68.

No dividend on the stocks of the associated companies was increased during the vear excepting the increase from 6 per cent to 7 per cent in the rate on the stock of the New England Telephone and Telegraph Company, made in the second quarter of the year.

During 1910 and 1911 over $23,000,000 of capital advances to associated companies were exchanged for stock of those companies. This exchange was for the most part in non-dividend paying companies that the parent company had been obliged to finance and build up from the depressed condition resulting from causes which were prevalent in the early days of the business, companies in which there was only a small percentage of the stock outstanding. These companies either now are or soon will be upon a secure, conservative, dividend-paying basis. The resulting decrease from this cause in the American Telephone and Telegraph Company's revenue is at the rate of over $825,000 per year, that amount additional remaining in the surplus of companies in which this company has about 95 per cent interest.

Due to the conversion of the bonds and the stock taken on subscriptions, there has been an increase of $55,091,900 in the outstanding share capital. The number of shareholders, 47,341, on December 31, 1911, shows an increase of 6,960 during the year, and increased to 49,011 on March 1, 1912. The distribution is general, there being 41,016 shareholders who hold less than 100 shares each, 5,971 who hold from 100 to 1,000 shares each, 324 who hold from 1,000 to 5,000 shares each and 30 who each hold 5,000 shares or more. The average number of shares held was 67. A majority of the company's stockholders are women. Less than eight per cent of the stock was on December 31 in the names of brokers.

The remaining $17,300,000 of four-per-cent collateral-trust bonds have been used during the year, together with other assets of the company, to carrv out the policies of the company in the acquisition of independent or opposition telephone companies, and in the acquisition of minority interests in the associated companies, as a part of the plan for the rearrangement of their territories.

The total outstanding capital stock and bonds of the American Telephone and Telegraph Company at December 31, 1911, were as follows:

Capital stock	$318,427,500
4-per-cent collateral-trust bonds	78,000,000
4-per-cent convertible bonds....	20,459,000
Total	$416,886,500

For the $318,427,500 capital stock, $339,633,235 has been paid into the treasury of the company; the $21,205,735 in excess of par value represents premiums. All discounts on the bond issues have been charged off. The outstanding capital obligations therefore represent over $21,200,000 more than their par value.

In a recent case before the Board of Public Utility Commissioners of the State of New Jersey that Commission stated:

"Assuming that adequate regulation in the public interest is provided, this Board avows its conviction that unified and exclusive control and operation of telephones with a given area is preferable to a competing telephone system

with its inevitable disadvantage of divided service and duplicate cost."

The Nebraska Commission has approved our plan for co-operating with the independent interests in giving universal service, and the legislatures of Ohio and Michigan have passed laws providing for the consolidation and merger of competing telephone companies under proper regulation.

We have not carried into the courts a large number of cases, but it has been our good fortune to be almost uniformly successful in those which have been submitted to their decision.

Engineering.

The year 1911 has, as usual, been an active one for the general engineering staff maintained at headquarters for the benefit of the associated companies throughout the United States. For every one of these companies a large number of important problems have been studied and solved and further substantial progress has been made in the improving and standardizing of apparatus and in the development of improved methods of rendering the telephone service to the public.

In improving the transmission of speech a most important work has been the development of methods whereby the loading-coil invention can be applied to the heaviest gauge wires and whereby such wires, when equipped with loading coils, can be operated on the phantom principle. By this means telephone service is now successfully accomplished between New York and Denver and the transmission of speech between cities less far apart has been greatly improved. By this application of the phantom principle to such circuits the available facilities have been largely increased so that between the important telephone centers notable improvements in service have been accomplished.

In long underground cables improvements have also been made so that the phantom principle may be employed in them, and the range over which speech may be transmitted has been so far increased that when this type of cable is installed between Boston and Washington it will be possible to talk underground between those cities and all of the intermediate points, which would have been impossible under the previous state of the art.

Engineering supervision has been given to the testing and inspection of construction material for the associated companies, amounting in value to $20,000,000.

Fundamental plans have been made for the associated companies in twenty cities. These provide for the proper location of subways and central offices so as to insure the most efficient growth of the plant. The construction contemplated in these plans amounts to more than $100,000,000.

The extraordinary advance in the price of tin, which enters into the construction of underground cable sheaths, and of platinum, which enters into the construction of the apparatus, has been more than compensated for by our improvements in cable manufacture whereby a small amount of antimony may be substituted for a larger amount of tin, and by our new methods of using platinum. Although less than three per cent of tin has been used in the cable sheaths the expense for tin has been $700,000 a year, and for platinum used in telephone apparatus the expense has been $550,000 a year. These figures have been cut about in half.

Rearrangement of Territory.

There has been some misunderstanding in connection with the acquisition of the minority interests of certain associated companies. In every one of these companies the American Telephone and Telegraph Company already owned a controlling interest, in fact, held about 70 per cent of the whole, which has been increased to over 95 per cent by the recent acquisitions. Each of the companies was an integral part of the Bell System. Each of the companies was connected with the others by the long-distance lines of the American Telephone and Telegraph Company, and each of the companies under license contract with that company.

The company is now in a position to carry out its policy of "rearrangement of territory," as outlined in previous reports, and without raising questions of conflicting interests, so to arrange the territory that it will conform to commercial and natural lines. In the few cases covering small areas not embraced in this control, the working arrangements are harmonious and the operations in perfect accord with the whole system.

Organization of the Bell System.

Under this rearrangement of territory the American Telephone and Telegraph Company, controlling the entire Bell System, will as it has in the past exercise the functions of a "centralized general administration." All questions of policy common to all, all common matters which may have an effect upon the system as a whole, will be settled by the Central Administration. As one administration will do for all what each would have to do for itself, it has the advantage of economy and will maintain uniformity.

For operating purposes there will be eight or ten divisions with boundaries determined by present commercial conditions, instead of a much larger number of divisions with boundaries fixed more or less accidentally or by other considerations prevailing twenty-five or thirty years ago. Each division whether operated directly or through corporate organizations will have a responsible local administration, supreme in the "intra-division" operations. Each division in turn will be divided into districts with a subordinate but responsible local administration, and in many cases these districts will be divided into sub-districts. In each district or sub-district there will be a subordinate but responsible local representative who will in all local routine matters be to the public the representative of the whole system.

Independent and Opposition Companies.

We have, wherever we could do so legally and upon satisfactory terms, and acting with the acquiescence and consent of the local public and local authorities, purchased, merged or made connecting contracts with a large number of independent or opposition companies. Wherever these arrangements have been completed and put into operation there seems to be general satisfaction with the result.

Statements are very freely made that whenever these combinations have been brought about rates have been increased to an unreasonable amount.

Rightly or wrongly—whether through ignorance or for other purposes—franchises for opposition exchanges were obtained on the promise of low rates and improved service, and capital was obtained on promises of large profits. These opposition exchanges were established as a rule in the cream of the territory and took in little or no unproductive territory, and built up no outside connection except where a profitable business could be obtained. The financial results are well known—few, if any, of the inducements held out were realized or promises made fulfilled. Increases in rates fixed in the franchise were applied for on the ground that without an increase the companies could not continue operation—many could not and did not continue.

In the face of these conditions, and excepting a few places where competitive conditions made it impossible, the Bell System has substantially maintained standard rates, averaging considerably higher than the opposition rates, and notwithstanding the higher average rate, the Bell gain in places where there was opposition was much greater than the opposition gain in stations.

Wherever these combinations have taken place the rates not standard have been made standard, and frequently no increases in rates took place, except such as were consequent upon the increase in the size of the exchange, and in no case have the rates even approximated the combined rates of the two exchanges.

We believe that our company has a most vital interest in, and that our future success and prosperity depend upon the working out of the telephone and telegraph problem in a way that meets with the approval of the public as a whole.

We believe, and we think the public is fast coming to believe:

That telephone service to be perfect must be universal, intercommunicating, interdependent under one control, and that no isolated section can be considered independently of any other or of the whole system, and that rates must be so adjusted as to make it possible for everyone to be connected who will add to the value of the system to others.

That the highest commercial value of the telephone service depends on its completeness, on the extent and comprehensiveness of its possibilities of intercommunication not only between individuals but between aggregations of individuals, i. e., communities.

We believe that we are working this problem out on the broad lines of the greatest benefit to the public, and that this is evidenced by the fact that our standards and lines of organization and operation are the standards the world over.

As a corollary to this—we recognize a "responsibility" and "accountability" to the public on our part, which is something different from and something more than the obligation of other public service companies not so closely interwoven with the daily life of the whole community.

But, in admitting this responsibility and accountability on our part, we must insist that the measure of it shall not be determined by impossible standards, that equity and fairness shall be, and personal and political exigencies or

partisan advantages shall not be, the basis of judgments and requirements.

We cannot conceive of anything more unfair than was the spirit which actuated a minority—small, it is to be hoped—of a political club which stands for high purposes, when it was proposed to pass a resolution recommending, "such action with regard to telephone rates and service as shall strengthen the party before the people of this state."

This is only illustrative of the tendency on the part of individuals or temporary bodies, without any, or at the best with a very superficial or partisan, knowledge, often prejudiced by their own interests, to attempt to pass on complex business questions.

In our relations with permanent bodies of control and regulation during the past year, we have had so little in the way of difference or difficulty as to be almost negligible. In presenting or defending our cases, we have tried to be governed by equity to ourselves and consideration to the public in every way, and have given such full reasons and such full facts to substantiate our cases that the only particular differences were those bound to exist between a public commission and a corporation, each trying to do what was best from its point of view.

Government Ownership.

The discussion of the government ownership of the wire companies is not likely to become anything more than academic, at least for the present.

Even if the final conclusion should favor government purchase of all wire plants, there would be no unfavorable consequences to the shareholders of the wire companies other than the obligatory liquidation. Any possible award for the property which the security holders would be obliged to accept would give them better than current prices for their securities.

Government operation of the telegraph would necessarily require the ownership, maintenance and operation of the transmission facilities and equipment, as well as the solution of many complex problems incident thereto, including that of profit and loss, all new to our form of government. Hundreds of millions must be invested in purchase or reproduction of facilities, all the charges on which, together with other costs, must be met out of the revenue from the service or become a charge on the general public revenue—all for the benefit of the comparatively few who would directly or indirectly profit by the use of the service.

The question of success or failure in any enterprise rests almost entirely with the organization. To create any new organization of such magnitude would be most difficult under favorable conditions, but the conditions which must control under government ownership would make doubtful the creation of an efficient and economical organization, or the profitable operation of a business which even under private operation has such a small margin of profit.

If the telegraph could take the place of the mails in popular use, all considerations other than public convenience might be brushed aside, but this it can never do; the great part of ordinary correspondence must be secret, it must be the written personal communication that is transmitted. The correspondence must not be limited in length or restricted in vocabulary, and in the ordinary affairs of life the time of transmission is relatively unimportant. The telegram may be used as an alternative but never as a substitute for the mails in the uses peculiar to them.

The facts are, that there is hardly a telegraph or telephone system in the world now operated by any government which shows a profit, even under accounting methods employed, and not one that would not show a deficit under accounting methods obligatory upon private enterprise. For authority, see any department report of any government telegraph system.

Another consideration, much misunderstood and often misstated, is the supposed superiority and cheapness of service in other countries.

Taking the kind and quality of service, the extent of territory covered and the wages to employees, there is no service in the world cheaper than the telegraph and telephone service of the United States. For authority, see statements made by departmental heads and reports of commissions of the various governments of Europe, and more recently of Manitoba, and the experience of travelers and business men the world over, and the statement of the Postmaster General of Great Britain who said in Parliament that if he could have the charges made in the United States, he could give as good service.

There is not a single instance of telegraph or telephone companies operated by private corporations in competition with government operation, where the private service is not better than the government and profitable, against unprofitable government operation, if untrammelled by government interference.

Telephone and Telegraph.

The inter-operations of the telegraph and telephone systems are improving rapidly. The collection and delivery of telegraph messages by telephone is becoming popular. Telegraph facilities have been largely extended, and will soon be much further extended, by agency telegraph offices established at telephone toll stations, and by the connection of the telephone system with telegraph "all-night" offices. All these innovations have been of convenience and advantage, but in case of emergency a great benefit, to the public, but they have not as yet been productive of economy in operation or of profit.

The Western Union system is to the telegraph situation what the Bell system is to the telephone situation, in that each tries to give a comprehensive universal service, but the comparison ends there.

The great economy and advantage would come from the "compositing" or simultaneous use of one system of circuits for the two services, eliminating entirely one of the wire systems. The advance in the state of the art of "compositing" lines for joint use of the telephone and telegraph has been very marked in the very recent past.

The annual gross revenue from either a telephone or a telegraph system should be approximately 33 per cent of the total cost of, or the investment in plant. If in two systems of equal size one plant were eliminated and both services were performed over the other, the percentage of joint revenue to plant would be substantially doubled, or 65 per cent. To put it in another way: The maintenance of a wire plant costs about 30 per cent of the annual gross revenue from that plant. The simultaneous use of a plant for both purposes would mean maintenance of one wire system against the doubled revenue from both services, or a decrease in maintenance alone of about 15 per cent of the gross revenue. In addition to these savings there would be the savings of the capital charges and of taxes on plant which would be made unnecessary. This brings within the realm of possibility a reduction of from 20 per cent to 25 per cent in the gross charges or gross revenue without affecting the profits of the business.

In order to avoid confusion it must be distinctly borne in mind that the telephone service referred to here is the toll or long-distance service and not the circuits of the exchange service which could not be used for any other purpose. This toll or long-distance service is so intimately interwoven and interdependent both in operation and use with the telephone exchange service that it could not be separated, but the operation of the toll circuits in connection with the exchange circuits would not interfere with their use for telegraph purposes by a regularly organized telegraph staff.

These are the possibilities, fraught with all sorts of advantage to the public. Some of them are so clearly without the "restrictions" of business operation that they can be put in operation as fast as the physical changes can be made in the plant, but those of the greatest advantage, prudence would dictate postponing until after these business restrictions are made clearer.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES FOR THE YEARS 1910 AND 1911.

Earnings:	1910.	1911.
Dividends	$19,205,494.35	$20,844,398.53
Interest and other revenue from Associated Companies..	10,838,442.84	10,462,786.70
Telephone Traffic (net)	4,894,513.39	4,979,231.92
Real Estate	95,119.69	92,854.41
Other Sources	325,758.44	590,958.21
Total	$35,358,328.71	$36,970,229.77
Expenses	3,425,114.22	3,668,984.00
Net Earnings	$31,933,214.49	$33,301,245.77
Deduct Interest	5,077,321.33	5,567,980.30
Balance	$26,855,893.16	$27,733,265.47
Dividends Paid	20,776,882.12	22,169,449.79
Balance	$ 6,079,071.04	$ 5,563,815.68
Carried to Reserves	$ 3,000,000.00	$ 2,800,000.00
Carried to Surplus	3,079,071.04	2,763,815.68
	$ 6,079,071.04	$ 5,563,815.68

ADVANTAGES OF THE COMBINATION ICE PLANT.

By H. J. Macintire.

In conjunction with the electric light or power station the motor-driven ammonia compressor will be found to give best results. The kilowatt-hours per ton of ice will be found to be often less than 50, and the cost of power will therefore be small. When operated under the same roof as the central plant, the same station attendants can have charge of the compressor, so that the only additional cost of operation will be in the can or plate room for the harvesting of the ice and for storing and shipping the same.

Within the last four or five years combination electric light and ice plants have become very popular, and have multiplied greatly. The reason for this is very simple, being one of economy. The electric light plant has a very poor load-factor, the peak load being of short duration during the early part of the evening. The result is high rates or a yearly deficit, unless a motor load or electric heating of some nature can be obtained to raise the load-factor. In the summer time, when both electric lighting and heating decreases in amount, some other means must be resorted to for improving the power output. It thereby happens that the production of ice or cold brine is a natural addition to the possibilities of the central station, and in a number of cases (especially in the South or the Southwest) the manufacture of ice alone has been the profitable business.

The combination ice plant may mean any kind of union of the isolated or the central plant with any kind of refrigeration. The power house for a large office building (as in the case of the Oliver power house in Pittsburgh) may supply cold water for its own building as well as for several hotels and department stores; it may circulate brine for the ice boxes of an apartment, hotel, for silk and fur storage in a neighboring warehouse, or, as with the Murphy Power Company, Detroit, it may be a central plant selling electric current, plate ice, exhaust and live steam and cold brine for cold-storage purposes. The method for the production of refrigeration may be either by means of an engine-driven compressor, by means of the absorption machine (or by the combination of the two) or by means of the electric-motor-driven compressor. The economical choice of the type to be used will depend on certain local conditions, which may be entirely different even in neighboring plants. In what follows a few of the principal factors affecting the economies will be emphasized. That more stress on this will be made in the near future is certain, on account of the increased cost of fuel and competition, or both.

As only relatively small steam engines, even in the largest refrigerating plants, are used to drive the compressors, the water rate per indicated horsepower is quite large, especially when it is remembered that only the very largest are compound condensing. The water rate for the simple Corliss engine is consequently quite high and amounts to some 25 to 30 pounds of steam or more per indicated horsepower-hour—the rate depending to a great extent on the initial steam pressure, the point of cut-off, the cylinder dimensions and the revolutions per minute. When compound condensing engines are used, the water rate is much reduced, but there is also the extra first cost and interest on the equipment and the high operating and maintenance expenses. The ice men content themselves with using the simple engine, however, by claiming that economy of steam is of secondary consideration only, for in the can system (which is the more popular and the cheaper) distilled water has to be placed in the cans if clear ice is to be sold. Why not then, they say, use the same steam for driving their compressors, especially as this can be done at little increase in the amount of coal burned under the boilers? The wisdom of this reasoning can be seen on considering all the facts. The exhaust from the engines contains as a rule from 80 to 85 per cent of the total heat in the steam entering the engines. This heat either escapes into the atmosphere or, if distilled water is used in the cans, is carried away by the condensing water. Approximately 900 British thermal units per pound of steam, or say 25x900=22,500 units per indicated horsepower-hour is thrown away—doing no useful work—and never to be regained.

Should, however, use be made of the absorption machine either singly (using the exhaust from the different auxiliaries) or in combination with the compressor, the economy per ton output becomes quite high. The operation of the two machines depends on two different properties of steam. The steam engine utilizes the expansive force or external heat, and a very small amount of the internal or latent heat—whereas the absorption machine utilizes all of the latent heat and a little of the heat of the liquid. The steam instead of being condensed by uselessly heating up the condensing water is made to boil off ammonia under pressure from an aqua, thereby increasing the refrigerating capacity, and the condensed steam from the coils of the generator is ready to be returned to the boiler or to be purified and cooled for use in the cans. It must be remembered that economical results can be obtained only by using exhaust steam for the generator. Therefore, where exhaust steam is plentiful, as in the combination with the steam-driven compressor or other steam prime mover, whether turbine or reciprocating engine, economical results may be obtained. A combination of the compressor and the absorption machine will more than double the capacity of the plant over that of the compressor alone, at very little additional cost. There will be necessity, of course, for additional power to drive the strong aqua pump, and to provide the extra cooling water, but the exhaust from these pumps, if steam-driven, may also be sent to the generator. Not only is the power cost of the exhaust-steam absorption machine very low, but the operating and maintenance cost is also. There are usually no repairs in the generator for some four or five years except perhaps the tightening of the packing, or the bolts, in the cylinder or heads. After six or seven years some renewals may have to be made in the coils of the generator, or in the cast-iron trays of the analyzer, due to the corrosive action of aqua on these metals, but the amount of this corrosion depends on the steam pressure carried in the generator, so that if exhaust of 3 or 3.5 pounds only is carried this action is not great. In any event the repair expense is small.

The disadvantages in the use of the absorption machine are two-fold—its bulkiness per ton of refrigeration as compared with the compressor and the greater first cost. Where land is valuable the size of the machine used (the absorption machine being some two to two and one-half times as bulky as the same capacity of compressor) is often a determining factor in the choice of the apparatus used. Then the first cost of the absorption machine is almost twice that of the same tonnage compressor. The use of the absorption machine, then, should be confined to cases where the power plant is not congested and where cheap exhaust steam is available in quantities.

In electric lighting or other central plants the size of the plant is usually sufficiently great to reduce the cost of power at the busbar to a small amount. A 500-kilowatt turbine at full load and a vacuum of 28 inches uses only 14 pounds of steam per brake horsepower and a 1,000-kilowatt turbine only about 13 pounds. Even better results are obtained with larger installations or by using the low-pressure turbine in

combination with the reciprocating engine where working on the same electrical load. Not only is there increased economy in the use of steam in the prime mover due to the larger size and better design of the machines used, but the equipment of the plant is likely to be of a higher order, economical apparatus such as primary and secondary heaters, flue-gas economizers, etc., are installed, and labor-saving devices such as automatic stokers, overhead coal bunkers and underground ash removal are provided for. The boilers are kept reasonably free from scale, and the boiler setting free from air leaks. When the ice machine is under the same roof with the central plant, the labor charge is also reduced, for this can be operated by the same station attendants, and the only extra charge is in the can and the storage rooms. So, if a motor-driven compressor is used, the benefit becomes a mutual one. The central plant furnishes a cheap power, and the ice machine furnishes a load when it is most needed, that is, in the summer when the electric light and heating demand is low. The ice machine then becomes an off-peak load, and it also has the advantage of raising the load-factor of the yearly output. The importance of the ice industry has been shown by the reports of a number of Southern electric light plants which were indicating a yearly deficit until the ice business was started, when a good net profit was reported.

The motor-driven compressor is, therefore, clearly the best for the central plant, but it is not yet clear that an electric drive is best in isolated plants. Yet in the latter it is simply a matter of the cost of a kilowatt-hour, either when purchased or generated in the same plant. In some central plants the cost of a kilowatt-hour is as low as 0.5 cent, whereas, as noted later, there are a number of localities where power may be bought for 2 cents or less. The kilowatt-hours per ton of ice or refrigeration is of primary interest, then, but whereas the latter may be approximated, both are variables depending on running conditions. The condensing or head pressure of the ammonia depends on the condenser used, but more so on the temperature and the amount of the cooling water. As the head pressure increases, the power necessary for compression also increases. For instance, in the vertical single-acting compressor, the indicated horsepower per ton refrigeration (of the compressor) has been found to be 1.2 for 145 pounds and 1.63 at a head pressure of 205 pounds. The horsepower per ton of ice not only depends on the head pressure, but also on the temperature of the water to be frozen, the temperature of the brine, and the degree of perfection to which the brine insulation has been carried. As all of these are variables depending on the time of year and the condition of the plant, a conversion rule, then, which will be correct for one case will be greatly inaccurate in another. Nevertheless a rough rule is often heard allowing 1.66 or more often 2.0 tons of refrigeration per ton of ice.

To arrive at a close approximation to the cost of a ton of ice using a motor drive, it seems best to use two diagrams—one for the cost of motor power per ton of refrigeration, and the other the conversion factor under different conditions. Fig. 1 is calculated allowing 15 per cent for friction in the compressor and the chain drive, and 90 per cent for the efficiency of the motor. Fig. 2 considers the ice when pulled to be uniformly cooled to 10 degrees Fahrenheit. The cost per ton of refrigeration is given for a number of rates per kilowatt-hour in Fig. 1, and the equivalent amount of refrigeration per ton of ice can be found in Fig. 2, from which the total power cost of a ton of ice can be figured.

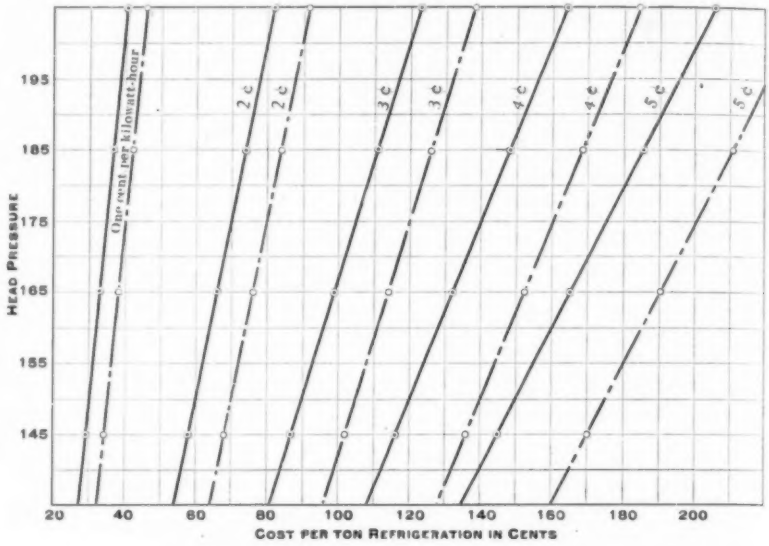


Fig. 1.—Cost of Ice with Motor Drive.
Full Lines are for Vertical Single-Actingpression.
Dot-and-Dash Lines are for Wet Com Compressor.

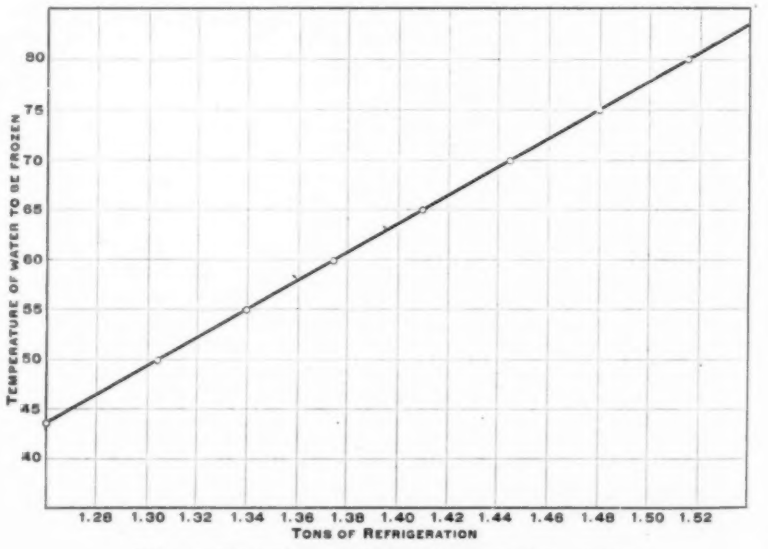


Fig. 2.—Equivalent Refrigeration per Ton of Ice.

So far nothing has been said in regard to the plate system and its costs. This installation is of greater first cost, and in several recent reports has also a greater operating cost. For instance, a motor-driven compressor in Buffalo

gave a power cost of 35.6 cents and a total cost of 71.6 cents for plate ice delivered to the loading platform, and when a multiple still for distilled water was used in the can system the power cost was 23.3 cents and a total cost of 62.1 cents per ton of ice.

The cost of manufacture is therefore a variable depending on the cost of power and the type of compressor used (whether vertical single-acting or horizontal double-acting), on the system used (whether plate or can), the temperature of the water to be frozen and the necessity for distilling or not, the operating, pulling and other station charges, and the cost of delivery. The cost per kilowatt-hour depends on the locality. Near Buffalo recent contracts call for from $40 to $48 per kilowatt-year, whereas at Keokuk it will be about $24. Out of the zone of the hydroelectric developments, however, the rates are much greater. In some localities—parts of Massachusetts, New York, Pennsylvania, etc., the rate is 2 cents per kilowatt-hour for loads of 25 kilowatts and over. The rate in Chicago is about 4 cents for off-peak loads, but there is a sentiment to discriminate in favor of the ice man, which will result probably in much better rates. In conjunction with a central plant, power should be delivered to the motor at from 1 to 2 cents per kilowatt-hour. For instance, at the rather small central plant at Noblesville, Ind., it is reported that the cost is one cent. It should be remembered that no idea can be obtained of the power cost per ton of ice until the power required for the auxiliaries is known. These vary with the amount and temperature of the cooling water, the type of cooling tow r used, the amount of brine agitation, and other variables. In the Buffalo plate-ice plant above mentioned about ten motors using 50 horsepower or one-quarter of the total of the compressor were required. When deep-well pumps furnish the cooling water, of course the power required depends on the depth. Likewise if a cooling tower is used, the power necessary to run it depends on the height of the top of the tower above the condenser and on the amount if any, of the forced draft required.

The cost of pulling the ice and other station charges are small. Two men working on 12-hour shifts can pull from 25 to 50 tons per day, and this cost will average about 25 cents per ton. The cost of delivery depends on the conditions of the streets—the degree of flatness of the routes—and the length of the haul. At the plant already mentioned in Indiana an average cost of delivery including the keep of the horses was 52.2 cents per ton.

Expert analysis on the condition of raw-water ice finds it as free from germs as the distilled-water ice, but if public opinion is greatly in favor of the latter a distilling apparatus with 10 or 12 cells can be used to advantage. The wound-rotor type of induction motor can be used, at only moderate loss of efficiency, to give a dozen speeds, and this is also true of the direct-current motors. The motor-driven compressors are of small size, easily and cheaply operated, and are efficient at a number of speeds.

Marconi on Wireless Progress.

One of the toasts at the dinner of the Junior Institution of Engineers, in London, on February 17, was "Electrical Intercommunication," proposed by John Perry, who referred to the promise of future rapid development in wireless telegraphy. He remarked also that cable work had advanced by leaps and bounds, and called attention to the cable from the Azores to America, which could send 220 letters a minute, or 440 both ways. The eleven Atlantic cables could in ten minutes send four newspaper columns.

The speech of the evening was that delivered in reply by G. Marconi, who is president of the Institution for the year. He said that wireless telegraphy had traveled a long way in distance covered, practicability, reliability and efficiency since he read his first paper before the Institution of Electrical Engineers. The introduction of high-speed apparatus enabled radiotelegraphy to successfully compete in speed with long-distance cables. Wireless telegraphy could make use of the improvement introduced in cable working, and wireless telegraphic speed was more or less a mechanical problem. Atmospheric-electricity difficulties had been gradually but surely overcome, and improvements in the receiver, and the effective utilization of a larger amount of energy in the transmitters, had been made. The natural effects did not have the same influence as they used to have, owing to the impulse at the receiving stations being so much stronger than formerly at a given distance, and in ship work, interference due to atmospheric conditions was very small. These new improvements made frequent communication possible, and in the tropic overland stations for a distance of 1,000 miles were often in touch with one another. Mutual interference, although they had only one ether, he thought would be minimized, as had been done in ships; and a larger number of high-power stations in England and Ireland had proved possible without mutual interference. The ease with which the number of stations could be worked efficiently without interference would determine the extent of the use of wireless communication. The international convention had fixed the wave-lengths, and in his opinion this caused some of the interference which took place. This could be overcome if a third and longer wave was authorized. The number of ships equipped with radiotelegraphy was very large as compared with three years ago, and the receipts for messages both in finance and commerce also showed a much greater increase. This could not have been obtained if the interference had increased with the number of installations in use. Mr. Marconi said that his experience taught him that the wave-lengths at present available ranged from 6 to 30,000 feet and this fact should be borne in mind. With a wave-length of six inches, communications for several miles could be obtained, but longer waves were necessary for long trans-Atlantic distances. Mutual interference was being overcome, too, by the wave-group tuning and directive systems available. Waves did not go all round and become a nuisance to people who would rather be without them, even though they spread a bit as the result of oscillation. These, and many other improvements with which he was in touch, convinced him that the new method of communication was destined throughout the world to be of the greatest importance in facilitating communication.

International Rubber Exposition.

The third international exposition of the rubber and allied trades will be held at Grand Central Palace, New York City, September 23 to October 3, 1912. A number of men connected with the rubber industry have subscribed $7,500, which sum is offered to the inventor who can suggest the best method of making rubber non-slipping for pavements, roads, etc., or for any use to which it may be put in all atmospheres and for all kinds of traffic. This sum will be divided into three prizes. The inventors will retain all rights to their inventions, the patents remaining in their own names.

Kentucky Telegraph War.

The installation and maintenance of individual telegraph and telephone service throughout the South by the Louisville & Nashville Railroad Company, of Louisville, Ky., seems to predestine war between that company and the Western Union Telegraph Company and the American Telephone & Telegraph Company in the near future. A current report says that the Louisville & Nashville will compete with the old service for general commercial business in the near future. The contract between the road and Western Union has not been renewed.

New Electrical and Mechanical Appliances

New Reco Flasher Design.

Flashers for electric signs and displays are constantly undergoing changes that tend to improve their utility, as well as their flexibility, and a marked departure from the former method of flasher construction will be noted in the 1912 model Reco flasher shown in the accompanying illustration.

The design of this flasher is entirely new throughout and embraces several features and improvements never before used in this work. As shown, the segments or contacts are made of heavy brass formed by special tools and fastened by bolts in slots which extend throughout the circumference of the drum. By this construction it is possible for any amateur to completely rearrange the flashing performance without the aid of any tools aside from an ordinary screw driver. A flasher of this type therefore may be used for a variety of effects other than that for which it is built; furthermore, the same flasher can be used for various signs or displays. Very frequently the sign builder or erector finds a minor adjustment necessary in the flasher and with the 1912 model Reco a slight change, or, if need be, a radical one, can be effected in a few moments. Anyone who has ever attempted changes with old-line flashers is bound to appreciate this improvement.

New Reco Sign Flasher.

Another advantage in the new design is the facility with which repairs are made. Should a contact wear or burn out it can be replaced in a few moments, it being unnecessary to disturb any part of the flasher other than the particular contact or contacts which require renewal. The collector ring is fastened in a slot by two screws in the same manner as the contacts. The brush holders clamp the brushes to a slate bar and enable the easy and quick adjustment of a brush; the holder also acts as a terminal convenient for wiring connections and has upturned lugs, as required by the Board of Fire Underwriters. The worm and gear are inclosed in an oiltight case and constitute a noiseless and self-lubricating transmission. The worm shaft runs on roller bearings; the bed plate of the machine is made of wrought angle iron and has an extension platform for the motor. The motor is fitted with a double-groove pulley of different sizes for speed adjustment.

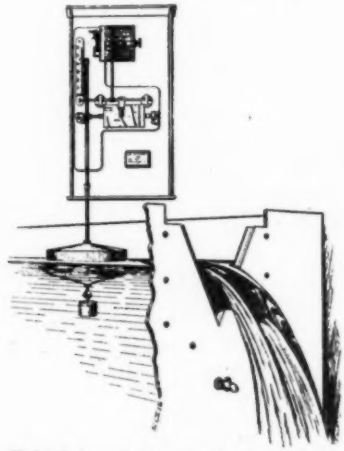
These flashers are made by the Reynolds Electric Flasher Manufacturing Company, of Chicago and New York. This company makes an extensive line of flashers for sign and special display service from the simplest to the most elaborate character.

The Cochrane Feed-Water Meter.

A very simple form of meter for measuring the input of feed water to boiler plants has been developed by the Harrison Safety Boiler Works, Seventeenth Street and Allegheny Avenue, Philadelphia, Pa. Its principle is shown by the accompanying diagrammatic sketch. Briefly it comprises a carefully calibrated weir with a V notch which is used at the outlet from a still-water chamber to the storage tank, usually of an open heater. All of the feed water passes through this weir. A float on the upper surface is connected with an indicating and recording mechanism. Each inch of depth of flow indicates a definite quantity of water and the indicating and recording device is calibrated to read directly in terms of quantity of water that has flown.

The weir chamber is built of heavy cast-iron plates and can be made an integral part of the feed-water heater, thus saving both initial cost and space. For indicating and recording the flow the Lea flow recorder is used. This comprises a float resting on the surface of the water above the notch, a rack on the stem of this float which actuates a pinion attached to a drum upon which is cut a spiral cam. The latter is so designed that it moves a pen equal distances for equal increments in the rate of flow. This pen records on a chart which is wrapped around a drum that makes one revolution each 24 hours.

From this chart the total flow in pounds of water per hour can readily be determined for any given period, also the variations in the feed-water input at various times. An automatic totalizing or indicating device can be added, if so desired. The integrated result is guaranteed to be within 1.5 per cent of absolute accuracy by weight. This feed-water meter can also be used for measuring the discharge of condensing auxiliaries or the feed-water input to closed heaters. It is extremely simple in construction and its accuracy can be readily checked.



Principle of the Cochrane Meter.

On March 9 one of the largest electric signs ever constructed was lighted for the first time. It is located on the Studebaker Building at Broadway and Forty-Eighth Street, New York City, and was constructed by the Kellogg Toasted Corn Flake Company. The sign depicts a youngster first scowling and then smiling. The sign measures 106 by 86 feet and contains over 4,000 tungsten lamps.

A New Mine Trolley Suspension.

The type B-3 mine suspension recently introduced by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., is unique in the simplicity of the clamp used. This clamp has only three parts; these cannot be taken apart and therefore are never dropped or lost.

Because of its simplicity the clamp can be installed quickly and cheaply. The clamp complete, with nut loosened, is screwed on the insulator stud; the wire is inserted in the lips of the clamp and slips freely into place without the least forcing; then the nut is tightened. Screwing down the nut clamps the wire firmly and also clamps the stud, so that the ear can be placed in any direction and yet be tight on the stud. This makes it unnecessary to twist the insulator after screwing the ear up tight. The wire can be

Mine Trolley Suspension.

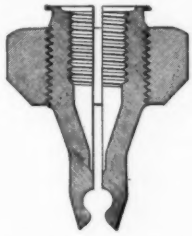
drawn through for taking up slack by simply loosening the nut. This does not permit the wire to drop out.

All parts of the clamp are sherardized, and perfect clearance for the trolley wire is provided. A wrench is the only tool required, making the installation as simple as possible. This clamp doubtless will appeal to mine operators who are on the lookout for a device of this nature that is absolutely foolproof.

Saved by the Mine Telephone.

The mines of the Girard Coal Company at Radley, Kans., have recently all be equipped with Western Electric Company mine telephones, and, according to the rules of the Coal Company, the shot-firers must report to the night engineer, by means of the telephone, the progress of their work as they go through the mine lighting the shots. This enables the engineer to know where his men are, so that if he does not hear from them at certain intervals, a rescue party is sent down.

One evening after the miners had left, the shot-firers went down as usual to fire the shots which would bring down the coal for removal during the next day. The two men had just entered a refuge hole and one was in the act of ringing the engineer to tell him they had lighted the shots in that particular entry, when an explosion occurred. The force of the explosion was so strong that it blew in the back end of the refuge hole, and



Section Through Mine Trolley Clamp.

the shot-firer did not even get to talk, but was immediately overcome by the after-damp. His partner, who was with him, was likewise overcome. The night engineer, knowing that this was the station from which they should next report, immediately tried to call them, but was unable to get any response and started the distress whistle. In fifteen minutes after the explosion had occurred a rescue party was in this refnge hole and had the two shot-firers out working upon them and succeeded in resuscitating them. A little later it would undoubtedly have been impossible to revive them.

There is an employers' liability law in some states which compels the operator to pay a considerable sum for loss of life or personal injury. The fact that the telephone very often prevents accidents and assists in quick rescue work, saves the operator a great amount of money. In the Girard Company's mines there were three severe explosions during the winter, but not

Van Expansion Bolt.

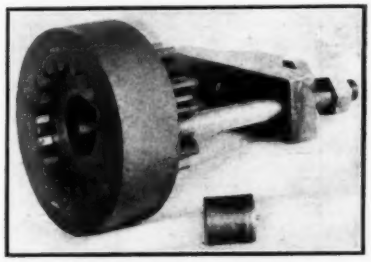
one of the Western Electric mine telephones was injured, nor was service interrupted.

The Van Expansion Bolt.

A distinctive type of expansion bolt has been developed by C. B. Van Antwerp & Company, Fort Dearborn Building, Chicago. As shown herewith its principal feature is a shell somewhat flexible at its inner end, within which is a cone that is drawn by the screw to exert a powerful expanding force. The shell has slightly raised ribs that give it a stronger frictional hold in the hole. The Van bolt is very readily installed. It is all ready in one piece and requires merely a screw driver to make it anchor securely. It has a temporary seal to prevent dirt from clogging the threads of the cone. The shell diameter is twice the size of the screw. Each part of the bolt is accurately made in steel die.

A New Railway-Motor Pinion Remover.

Realizing that a demand existed for a suitable device for quickly removing pinions from railway-motor armature shafts, the General Electric Company has placed on the market the pinion-puller shown herewith. This device is light in weight and can be handled easily and quickly by one man. The ring is slipped over the pinion, its teeth passing between those of the pinion, and then a slight turn brings the teeth of both in line. The cylindrical piece of metal shown in the foreground of the illustration is then placed between the shaft and the jackscrew passing through the middle of the yoke. By



Puller for Railway-Motor Pinions.

screwing the jackscrew into the collar the pinion is easily removed.

The two bolts holding the yoke to the ring are of liberal length to permit adjusting the device for the removal of pinions of any thickness met with in practice which have the same number of teeth as the pinion-puller. The complete line includes pullers for all railway-motor pinions.

Telephone-Transmitter Details.

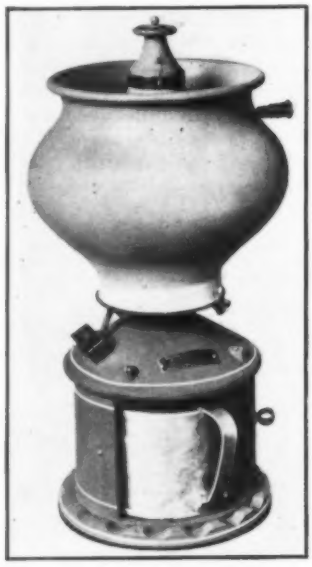
The transmitter, as found in the great majority of telephones, is made up of 59 details or parts, not including over 50,000 granules of carbon, which are incased in a closed cup. Each detail of the transmitter is made as carefully as the most delicate part of an expensive watch. The outside of the transmitter is strongly built.

Through the medium of these instruments, it is now possible to transmit speech from New York to Denver, a distance of 2,050 miles. Less carefully made transmitters would fail utterly

in such a project. In a short time the line will be extended to San Francisco, when, if the hopes of the telephone engineers, who are engaged in the work, are realized, the dream of transcontinental telephone communication will have come true.

Electric Coffee Mill.

The new Oerlikon coffee mill, illustrated herewith, is of the latest European design and is likely to be favored in households, as it is claimed to avoid all the drawbacks and make coffee-making a pleasure. It is very compact, the electric motor is placed inside the hopper and there are no gears or cumbrous mechanical parts to give trouble. Such mills are made in large and small sizes, from household mills up to large ones for wholesale groceries. For the



Oerlikon Coffee Mill.

latter it is a great item to be able to grind large amounts of coffee or spices in a short time, so that the present electric mill is likely to be a favorite for these cases, as well as for hotels, restaurants or on shipboard. As it is self-contained it can be stowed away in a very small space.

Silent Waverleys in Philadelphia.

The Philadelphia dealers in electric automobiles and the manufacturers of electrics represented there recently combined in a newspaper campaign of club advertisements in each of which all the leading makes were mentioned, the idea being to attract attention to the superior advantages of the electric car for urban and suburban travel.

The campaign had been in progress but a few weeks when an order for four high-priced Waverleys was received by the Waverley Company.

The New Appleton Receptacles.

The accompanying illustrations show three forms of the new receptacles made by the Appleton Electric Company, Chicago, to fit rectangular "Unilets." These receptacles are made for one-half-inch, three-quarter-inch, and one-inch rectangular "Unilets." They

New Forms of Appleton Receptacles.

are of porcelain, are made moisture-proof by the use of a rubber gasket, and can be used in outlining work on buildings.

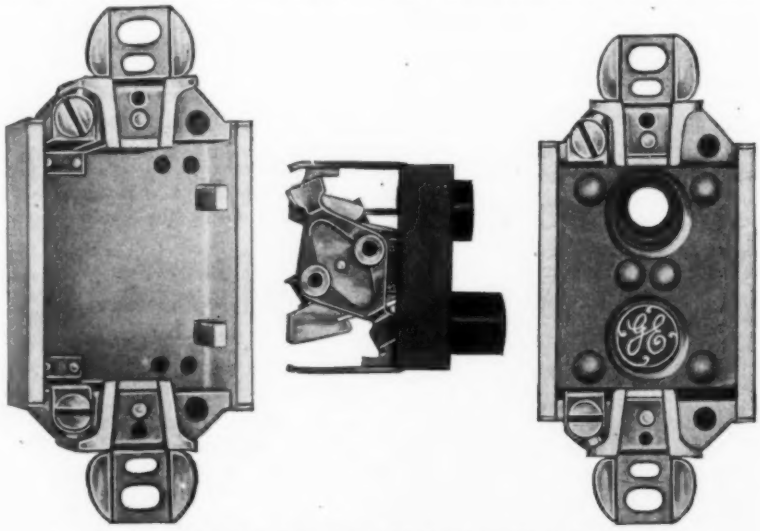
The receptacles are made in two pieces, are simply installed, and the connections are easily made, as it is not necessary to cut the wires, which can be put under the binding screws and soldered if required. They are made in two styles, with or without shade holders, and have been installed with satisfaction by some of the largest contractors.

Removable-Mechanism Wall Switches.

A new line of wall switches has been developed by the General Electric Company that will prove of much interest to the wireman and contractor. In the installation of a house-wiring system a difficulty that has been experienced is the proper protection of wall switches after their installation and before the finishing work is done. If these are placed while the rough wiring work is being done they are in danger of being befouled by dirt and plaster, so as to damage them or render them inoperative. On the other hand, it is desirable that the box or casing of the switch be in place before the plastering is done so as to insure a neat workmanlike job.

In the new line of wall switches referred to the mechanism is a distinct and separate part from the casing of the switch, and can be readily removed therefrom. In installing these switches it is merely necessary to secure the box in place and connect it with the conduit system. After all of the rough work and plastering is completed and the fixtures are ready to be placed, the switch can readily be inserted at the same time that the wall plates are installed, thus completing the job ready for service.

In the accompanying illustrations the switch is shown without the mechanism, that is with the box alone, and also with the switch inserted. Another view shows a side elevation of the switch mechanism, just as it is ready to be inserted into the box.



General Electric Removable-Mechanism Wall Switches.

A double-end electric locomotive has been completed by the Westinghouse Electric & Manufacturing Company for the British Columbia Electric Railway and will be operated on 600 volts, direct current, with control from either end. The powerful machine is 31 feet, 1 inch in length, 9 feet, 6 inches in width, and weighs 90,000 pounds.

An Improved Giant Strain Insulator.

The giant strain insulator shown in the accompanying illustration has been designed with a view to maintaining permanently its high insulation resistance and exceptional mechanical strength.

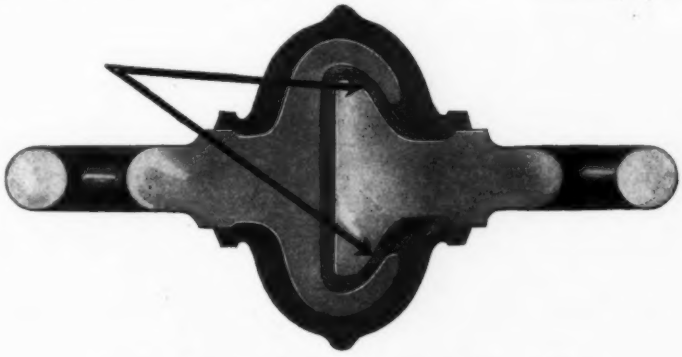
The two metal parts are insulated from one another by layers of sheet mica, each sheet having sufficient dielectric strength to withstand the potential for which the insulator is designed. The malleable-iron cup casting is crimped over the stud casting by a pressure of 40 tons, thus making an absolutely rigid insulated joint. Any movement of the parts is thus prevented when the insulator is subjected to tension or temperature changes and the mechanical strength of the insulator is limited only by the strength of the malleable-iron eyes or clevises, which are designed liberally so as to withstand the severest service conditions.

A non-absorbent insulating compound is molded over the entire insulated joint, making it waterproof. Owing to the rigid joint this molded insulation is subjected to no mechanical strains. Its exterior surface is so formed that it provides ample creepage surface and effectually prevents a continuous film of moisture from forming between the metal parts. The latter are sherardized which effectually prevents corrosion.

Every insulator is tested mechanically at one-half its ultimate strength, the two-inch size at a tension of 2,500 pounds and the 2⅝-inch size at a tension of 4,000 pounds. Both sizes are subjected to an alternating-current potential test of 5,000 volts for five seconds.

This insulator is manufactured by the General Electric Company, Schenectady, N. Y.

Giant Strain Insulator.



Section Through Insulator Showing Sheet Mica.

National Railway Appliances Exhibition.

In connection with the conventions of the American Railway Engineering and Maintenance of Way Association and the Railway Signal Association that were held during this week at Chicago, there was held the fourth annual exhibition of the National Railway Appliances Association, composed of manufacturers and dealers of railway appliances and supplies. The exhibition was larger than ever and occupied all of the Coliseum, Coliseum Annex and First Regiment Armory. The exhibition was held all week and was attended by thousands of railway men. Most of the exhibits had to do with the construction and maintenance of the permanent structures of trunk-line railways, and there were scarce any displays of rolling stock or motive equipment. Among the exhibitors of electrical appliances, machinery and supplies were the following:

American Railway Signal Company; signals.

American Steel & Wire Company; iron, steel and copper wire.

American Vulcanized Fibre Company; track insulation.

Bryant Zinc Company; primary batteries and signal supplies.

Chicago Pneumatic Tool Company; electric and pneumatic tools, motor-driven air compressors, work cars.

Joseph Dixon Crucible Company; graphite paint and other graphite products.

Edison Storage Battery Company; storage batteries.

Thomas A. Edison, Incorported; Edison BSCO primary batteries.

Electric Railway Signal Company; signals.

Electric Storage Battery Company; storage batteries.

Fairbanks, Morse & Company; electric turntable tractor; oil-engine-driven dynamo set.

Federal Signal Company; signals.

General Electric Company; electric lamps, motors, generators, motor-generator sets, flow meters, rectifiers, compressors, instruments, gas-electric car.

General Railway Signal Company; signals.

Hall Signal Company; signals.

Hubbard & Company; tools and specialties.

H. W. Johns-Manville Company; asbestos products, electrical supplies and specialties.

Kellogg Switchboard & Supply Company; telephones for all railway purposes, including dispatching and composite systems.

Kerite Insulated Wire & Cable Company; wires, cables.

Luitwieler Pumping Engine Company; motor-driven non-pulsating pumps.

Nachod Signal Company; signals.

National Carbon Company; dry cells, cell-testing set.

George P. Nichols & Brother; electric turntable tractor.

Northwestern Manufacturing Company; motors and generators.

The Okonite Company; insulated wires and cables.

The C. F. Pease Company; electric blue-printing machines.

The Rail Joint Company; insulated and other rail joints.

Railroad Supply Company; signals.

Sandwich Electric Company; telephones for composite and dispatching systems, crossing signals.

Standard Underground Cable Company; electrical cables.

Union Switch & Signal Company; signals.

United States Electric Company; Gill selectors for telephone train dispatching.

United States Light & Heating Company; National storage batteries.

Weir & Craig Manufacturing Company; electric hoists, turntable tractors.

Western Electric Company; telephones of all kinds, including dispatching equipment, motors, generators, Mazda lamps, specialties and supplies.

Detroit Electric Fireless Cooker Stoves.

The advantages of electric cooking are so well known that it is needless to review them. Again, the desirability of using the so-called fireless cookers is also appreciated in many quarters. The combination of these two systems of cooking is comprised in the line of fireless electric stoves made by the Detroit Fireless Stove Company, 90 Jefferson Avenue, Detroit, Mich.

These are made in a great variety of sizes and styles, suitable for any size of family. The principal classes are two, first those in which there are one or more deep compartments somewhat resembling the ordinary types of fireless cookers. The other class is built on the order of a range, as shown in one illustration on the following page. This is rather more convenient because it makes the heating chambers accessible without stooping. In the electric fireless range one or more heating chambers are provided, and at one end there is an electrically heated griddle built for toasting, frying and such other cooking where special speed is necessary.

In all forms of the Detroit fireless electric stoves the preliminary heating is done directly in the heating chamber, there being an electric heating element

mounted beneath it. In the sectional diagram shown herewith the construction of the chamber is well shown. At its base is a cast-iron block directly beneath which is the electric heating element, which is removable from below. This protects the latter completely from danger of short-circuiting from moisture or mechanical abrasion. The heat insulation is on the Areocell asbestos system. This embodies alternating air cells or compartments and asbestos mats or boards. The heating chamber is lined with heavy sheet aluminum. A V-shaped groove runs all around the upper edge of the heating chamber. A corresponding projection in the cover makes a close fit in which any steam given off from the food is cendensed and forms a substantial water seal that retains the heat, steam and odors effectively.

The outer cases of these fireless stoves are made of Wellsville planished steel. No wood or inflammable materials are used in any part of the construction. All parts of the stoves are made with accurate dies and are highly finished, which makes them easy to keep clean.

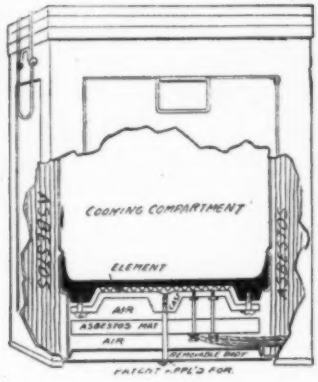
With each stove goes a series of aluminum kettles closely fitting the heating compartments and each provided with a self-locking cover. There is also a pie rack. For the deep stoves it is possible to place two kettles above each other, thus economizing in floor space, but making it slightly less convenient. In this case a cast-iron division plate is placed between the two kettles. In those stoves where more than one compartment is provided these compartments are of different sizes so as to enable that one to be used which is best suited for the quantity and kind of food to be prepared.

An automatic clock regulator is provided for these stoves. As it is necessary to heat the food only a relatively short time, varying from 10 to 35 minutes, the regulator permits an exact setting of what amounts to an automatic switch that cuts off the current from the heating element when the preliminary heating should be finished. This device permits the cooking operation to be begun and left entirely automatic, so that it is not even necessary to cut off the current. The heating having been once provided, the insulation all around the heating chamber retains the heat and cooks the food while other work is being done. The food is exceptionally well cooked in this manner and remains hot until it is to be served. In those stoves where more than one heating chamber is provided, any one of these may be used at one time connected with the ordinary lighting socket. If more than one is to be used at one time extra-heavy or duplicate service connections must be provided.

As the current is actually used several hours before meal time, practically off-peak load is insured; this should appeal to central-station companies.

The makers of the Detroit electric fireless stoves state that repeated and conclusive tests have shown that this method of electric cooking is very much more economical than any method involving the use of gas, coal or other fires, because the current is used for only a very limited time; a roast, for instance that would take two hours heating in a gas range, needs the application of current for but 35 minutes. Moreover, there is practically no shrinkage of meats such as is so common with gas or coal stoves. This feature alone is a very important one in making the economy still greater.

Detroit Electric Fireless Cooker Stove.

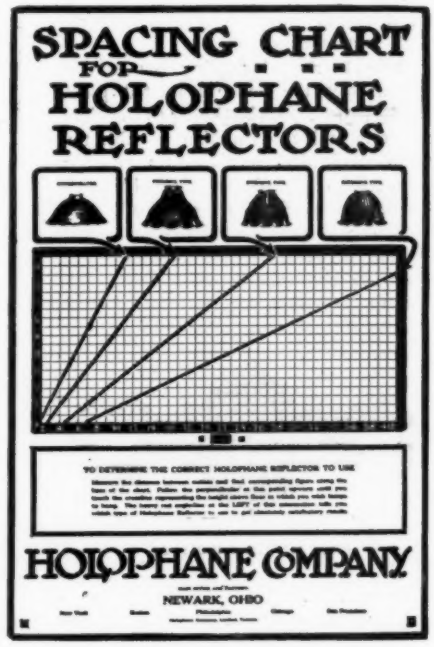


Detail of Compartments.

A Chart That Specifies Reflectors.

The Holophane Company has just published as a wall hanger a spacing chart that tells at a glance just which Holophane reflector should be used for the equipment of lights of any given height and spacing in order to secure the most efficient and appropriate illumination. The principle of the chart is shown clearly in the reproduction herewith.

To determine the correct reflector to use under any conditions, it is only necessary to measure the distance between outlets and find the corresponding figure along the base of the chart. Then follow the perpendicular line at this point until you touch the cross line representing the height above the floor at which you wish the lamps to hang.



Reflector-Spacing Chart.

Then the heavy angle-line first encountered to the left of this intersection points out for you which type of Holophane reflector to use to obtain satisfactory results. The four types of reflectors represented provide for all conditions encountered in the average commercial installations, and it is these store and office systems that make up the bulk of the contractor's lighting work.

This spacing chart will be found a great convenience. It reduces illumination calculations to the simple process of putting your finger on the chart and following out the line. It also enables the man behind the counter to know off-hand just which reflectors the customer should buy to secure satisfactory results under the space conditions prevailing.

Rubello-Santi Cement Poles.

The objections urged against reinforced-concrete poles as compared with iron poles are that the reinforcement is hard to hold in place, difficult to anchor within the molds and there is a tendency to separate the reinforcement from the concrete by any uneven strain or swaying of the pole, the whole construction requiring much skilled labor in both bonding the reinforcement and tamping of the concrete.

In ordinary construction, round or square bar iron is employed for the uprights which are bonded or held together by wire wound in coils and tied to the uprights, at frequent intervals, or woven in sections with hinged joints. All this must be performed by skilled hand labor, making the preparation very expensive. There is no method or

Fig. 1.—Mold for Cement Poles.

system now in use for holding the reinforcement centrally within the molds, other than with wooden cleats which weaken the pole and deprive it of uniformity. The pouring and tamping of necessity require great care to avoid disarranging the bands or ties which lack rigidity in any method of permanent attachment with the uprights.

All this is overcome by the Rubello-Santi system, as the reinforcement is rigidly held in position as though it were one piece. The concrete may be applied either in an upright position, for very large poles, or in a horizontal position, for smaller poles, with no danger of misplacing the reinforcement. This kind of reinforcement is adaptable to either solid or hollow poles. The latter are preferable because of their much greater lightness.

To provide for the steps or climbing cleats, the most economical method is that of placing greased pins of correct diameter, in the sides of the pole, and withdrawing them before removing from the mold. In the holes, so formed, the necessary steel steps can be inserted when the pole is ready for erection, by slightly bending them where they are to be permanently fixed in the pole and then setting them with a thin mortar of cement and sand, or some similar substance. This saves a large cost in forms and time in arranging cover-up slips for the slots, and eliminates all danger of the steps breaking out of the concrete while removing or handling. For safety and convenience, as well as protection against damage, it is more economical to place the steps after the poles are cured, or possibly after they are set.

One very important feature of the Rubello-Santi system is that of the spacing-reinforcing rings or squares. They hold rigidly and at predetermined distance the whole reinforcement (rods and rings) from the walls of the mold, producing uniformity of concrete surrounding the reinforcement, with corresponding uniformity of strength capable of withstanding a strain from any direction. These rings have an intense binding effect which reinforces the concrete.

The Standard Cement Pole Company of America, 25 Broad Street, New York City, owns and controls the Rubello-Santi system under its patent relating to reinforced-concrete construction for hollow poles. In these poles the reinforcing members consist of a plurality of metallic rings imbedded concentrically in the concrete and variably interspaced, all the rings being united by steel rods which run parallel through a number of perforations with which the rings are provided. These rods taper toward one end of the pole where, as is usual, a somewhat conical form is desired. These spacing rings, which are preferably made of cast iron, are provided around their circumferences with equidistant integral spherical protuberances or knobs. The latter are provided with openings or perforations to permit the passage therethrough of the spaced rods. The rings so constructed are economical in manufacture and permit a slight and slender skeleton frame to be made with adequate strength and stability. At occasional points around the peripheries or outer space of the rings, as, for instance, at four or more equidistant points in the circumference, the knobs or protuberances are extended radially to form tapered pins or spikes of equal length, thus acting as additional reinforcing elements and as a means of centering for the whole reinforcing structure in the pole.

In the manufacture of these poles a portable sectional steel mold is used with a collapsible steel core. Fig. 1 shows part of the mold and gives a fair idea of the method of reinforcing with steel rods held in place by spacing rings or squares. Fig. 2 shows a row of 30-foot poles erected in boggy ground near Flushing, Long Island.

Synchronous Motor-Generator.

An interesting application of a Westinghouse synchronous motor-generator set is that in the tunnel substation of the Pittsburgh Railways Company, Pittsburgh, Pa. This is an application of a synchronous motor used for power-factor correction and at the same time driving a mechanical load.

The set consists of a 1,500-kilowatt

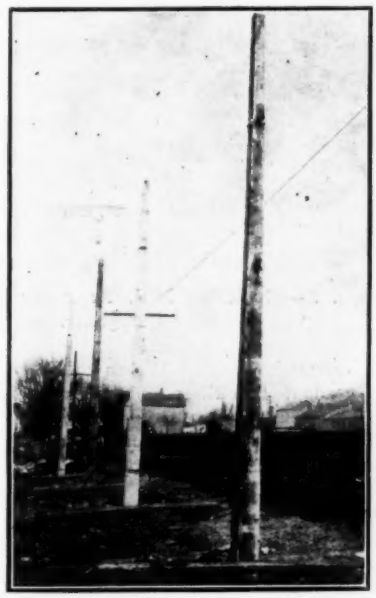


Fig. 2.—Row of Cement Poles.

motor-generator group running at 360 revolutions per minute. The generator is wound for 550 volts direct current and supplies energy to the trolley system. The motor, wound for 10,000 volts, 60 cycles, has a rating of 2,340 kilovolt-amperes and is especially designed for operation at 70 per cent power-factor for corrective purposes. At present the load on the system supplying the motor-generator is of such a nature as to make advisable the operation of the set at only 100 per cent or at very slightly leading power-factors. In the event, however, of a change in the character of the load, there is available for power-factor-correction purposes, in addition to the corrective effect of the power component furnished to the direct-current generator, 1,635 leading reactive kilovolt-amperes.

The Maxicator.

An ingenious device has been developed by the Chicago Electric Meter Company for adding to a standard watt-hour meter a maximum-demand indicator. It is particularly designed for use in metering the service to relatively small consumers having a connected load of 50 horsepower or less and is called the Maxicator, meaning maximum indicator. It has already been adapted to three standard makes of watt-hour meters.

The Maxicator is a combination of maximum-demand indicator and watt-hour-meter register and takes the place of the original register on the watt-hour meter. It has four dials, similar to those of the watt-hour-meter register, from which to obtain the reading of total consumption, but in addition is equipped with a larger center pointer which indicates on a scale on the margin of the dial plate the maximum demand during a half-hour interval over any period, such for instance as a week or month. This larger hand constitutes merely a friction pointer, the friction being obtained by means of a leaf spring bearing against the shaft. This maximum indicating pointer is carried forward by means of a driving "set-back" pointer connected directly by gearing with the register movement. This set-back element is controlled by means of a solenoid mounted on the back of the register as shown in Fig. 2 and connected to the gearing through a rack and pinion.

Energization of the solenoid from the line by means of a contact-making motor, shown in Fig. 3, draws the plunger up to its seated position and revolves the driving pointer to zero. The factor which formerly prevented the application to a meter of a device performing functions similar to those of the Maxicator, was the excessive friction introduced. The Maxicator, however, by means of gravity and the escapement principle, has entirely eliminated this disadvantage. To prevent this additional load being imposed on the meter, the plunger of the solenoid which is raised at the end of each 30-minute interval—to set back the driving element to zero—descends during the next succeeding interval, thus furnishing the power necessary to drive the entire register movement, the meter acting only as an escapement in regulating the speed of falling.

This indicating hand always remains in the position to which it is carried until a higher reading is obtained during a subsequent 30-minute interval, the driving element alone being set back, thus leaving the indicating hand at the highest point reached during the week or month. At the end of a week or month or any length of time for which the maximum is desired, the indicating hand may be set back to zero by unsealing a thumb nut which is provided in the meter case furnished. This operation should be performed by the meter reader.

A complete installation of the Maxicator includes one Maxicator and one contact-making motor. This motor is of special design and is made exclusively for use with the instrument shown in Fig. 1. The motor mechanism is composed of a single-phase, 220-volt, self-starting induction motor, which is operating at practically no load, thus giving a uniform speed at all times. Through a train of reduction gearing a speed is obtained upon the last spindle of one revolution every 30 minutes, the contact element being directly connected to this spindle. A motor of this type should run continuously without attention for approximately two years, thus doing away entirely with the former complications introduced in connection with the timing element.

The Minerallac Electric Company, 112 West Adams Street, Chicago, acts as a distributor for the manufacturers of the Maxicator and of the Printometer, the latter being applied to larger watt-hour meters.

Fig. 1.—Maxicator Dial, Replacing Watt-Hour-Meter Register.

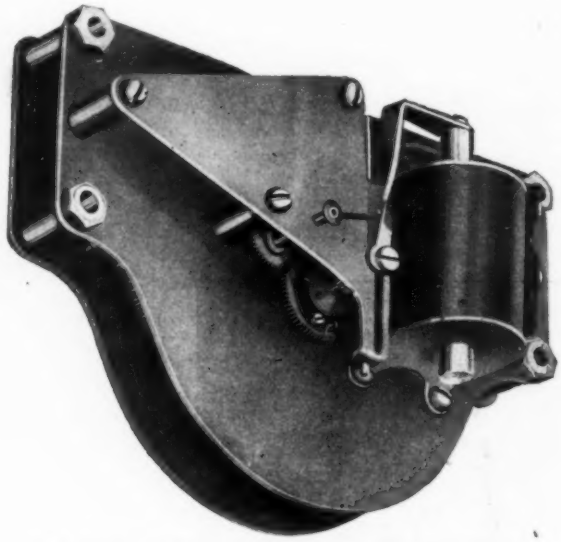


Fig. 2.—Rear View of Maxicator, Showing Dial Mechanism.

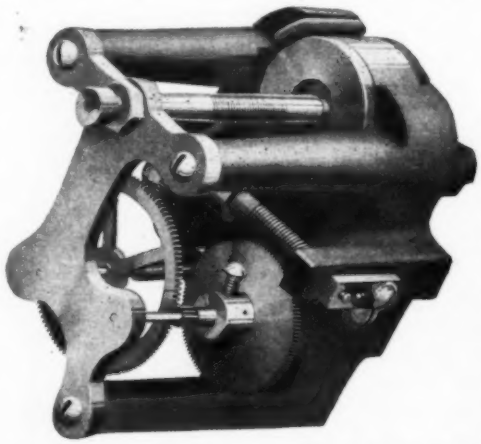


Fig. 3.—Motor and Contact-Making Mechanism for Maxicator.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

GEORGE, IOWA.—H. C. Hatch has been granted an electric light franchise here.

CUERO, TEX.—The Cuero Light & Power Company will make improvements to its plant. D.

MARQUETTE, NEB.—Bonds of $12,000 were voted for an electric light and water works plant. C.

MARQUETTE, NEB.—This city has voted bonds for $12,000 for an electric light plant and waterworks.

SIOUX CITY, IOWA.—Plans are being discussed for the proposed electrolier lighting on Sixth Street. C.

BURLINGTON, IOWA.—Merchants are preparing for the Boulevard lighting system for Jefferson street.

BLACK ROCK, ARK.—L. P. Caldwell, of Batesville, Ark., has the contract to improve the electric light plant.

RED WING, MINN.—The council is discussing the construction of a "White Way" along the business streets. C.

CENTRAL CITY, IOWA.—F. J. Cross of the electric light plant will build an electric line to Stone City and other towns. C.

NORFOLK, VA.—The Deep Creek Lumber Company is contemplating the erection of an electric light and power plant in Norfolk.

CEDAR RAPIDS, IOWA.—Franchises have been voted here for electric lights, steam heat and an interurban railway.

BOAZ, ALA.—The city has completed arrangements for the construction of an electric light plant. W. H. Barlett is mayor.

LEWISVILLE, N. C.—N. E. Whitman and others are reported as being interested in the establishment of an electric light plant here.

LULING, TEX.—The firm of Karnstadt, Wade & Stair has been given permission to erect an electric light and power plant in this city.

NEWTON, IOWA.—A four-panel marble switchboard will be installed at the light plant. Various other improvements are also planned. C.

MOUNT DORA, FLA.—The Town Council has granted a franchise to Eustis Light, Water & Power Company, Eustis, to furnish electricity.

ANTRIM, N. H.—The town has under consideration plans for the establishment of an electric light and power plant on the North Branch River.

VILLISCA, IOWA.—The proposition carried to issue $10,000 bonds for the construction of an electric light plant. George B. Sexton is city clerk.

SWAINSBORO, GA.—The city has voted a $7,000 bond issue for the purchase of a local electric light plant. For further particulars address the mayor.

ATLANTA, GA.—J. E. McClelland, chairman, Electric Light Commission, will receive bids until April 3 for furnishing electric street lighting here.

OAKLAND, IOWA.—The Oakland Electric Company has been organized by J. W. Tubbs and Dan Dermeyer to install a lighting plant. C.

WILMINGTON, DEL.—The Street and Sewer Directors have under consideration replacing about 300 arc lamps with modern incandescent lamps.

JAMESTOWN, N. D.—The City Light Committee has an elaborate design for the new lighting system. It is planned to install five cluster light standards. C.

WINSTON-SALEM, N. C.—The R. J. Reynolds Tobacco Company is planning the erection of another immense power plant. Plans are now being drawn.

DUBUQUE, IOWA.—Washington and Jackson Parks will be lighted in the near future with electroliers. The standards will be constructed of granite cement. C.

PETERSBURG, IND.—Bids for a 10-year franchise for the lighting of Petersburg by electricity are being readvertised for, all previous bids having been rejected. S.

CATHLAMET, WASH.—W. J. Haycox and associates have been granted a 25-year franchise to utilize the immense waterpower of the Elocoman River for generating electricity.

WAYNESBORO, PA.—A project is on foot to erect a $20,000 electric power house at the Old Forge on Antietam Creek by a number of people from Leitersburg, Ringgold and Smithsburg.

LEWISTOWN, MONT.—The Lewistown Electric Light & Power Company will build a high-tension line from Rainbow Falls to Lewistown and will make many improvements locally.

HENDERSON, TENN.—Priestly-Loyd Light & Power Company has been incorporated with a capital stock of $10,000 by C. W. Priestly, P. R. Priestly, J. H. Priestly and A. C. Loyd, Jr.

NEW BADEN, ILL.—New Baden Light & Power Company has been incorporated with a capital stock of $12,000. The incorporators are Fred J. Koch, L. A. Schumacher, Fred Bilhartz.

PLYMOUTH, IND.—It is reported that the Commissioners of Marshall County have granted Harry Sane a franchise to construct and operate a transmission line between this city and Culver. S.

LOVELAND, COLO.—The city of Loveland will soon build a municipal electric light plant at an approximate cost of $100,000. The site chosen is on the Big Thompson River, about 13 miles west of here.

READING, PA.—Barr & Bachman, electrical contractors and engineers, Allentown, propose to build an electric light plant to supply light and power for residences located between Kempton and New Tripoli.

ARCADIA, NEB.—E. D. Bennett, Pulaski, N. Y., proposes to construct a power plant here to cost $200,000. By the use of water from the Middle Loup River electric energy will be developed for use at Arcadia and for sale to surrounding towns.

SAN FRANCISCO, CAL.—The Universal Electric & Gas Company has filed articles of incorporation with capital stock of $5,000,000. Rudolph Spreckels, San Francisco, and Claus A. Spreckels, New York, are the principal stockholders.

HEBRON, N. D.—Theodore Bolke & Company has been formed here for the purpose of building and maintaining an electric system to furnish light, heat and power to the inhabitants of Hebron. A 25-year franchise has been granted to the company.

LINCOLN, NEB.—H. E. Babcock, of Columbus, is the promoter of an immense electrical project, which if completed will mean an outlay of over $6,000,000. It is proposed to furnish 36,408 horsepower for the development of electric power plants to be distributed along the Platte River.

LAPORTE, IND.—The merger of the electric railway, electric light and power plants, controlled by the syndicate headed by Samuel Insull, of Chicago, which includes the Laporte electric light plant, means that extensive improvement will be made to the later plant, work to begin at once. S.

ROSSVILLE, TENN.—The City Council has granted a franchise to the Chattanooga Railway & Light Company to erect poles and wires over the streets of Rossville. Power from Ocoee plant will be run in here and used not only to light residences but to operate factories and light the streets.

COLUMBUS, GA.—The Columbus Power Company is preparing to build a power transmission line of the latest type, with steel towers for the support of the wires, from its Goat Rock dam on the Chattahoochee River, 15 miles north of Columbus, to Newman, via LaGrange, a distance of 65 miles.

MARBLE FALLS, TEX.—The Colorado River Power Company, which is constructing a dam across the Colorado River here and installing a hydrolectric plant, is arranging to construct a system of power transmission lines in a number of towns in this part of the state. One of these lines is to run to San Antonio, a distance of about 100 miles. C. H. Alexander of Dallas is president. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ASHVILLE, ALA.—S. R. High, cashier, Ashville Savings Bank, and associates will construct a telephone system here.

AITKIN, MINN.—The East Side Cedar Lake Telephone Company is to build a line connecting this town with Deerwood.

SAN JOSE, CAL.—E. D. Frank has been granted permission to build a telephone line between Lexington and Los Gatos.

McLOUTH, KANS.—The McLouth Mutual Telephone Company has been incorporated by J. W. Harding, J. H. Jones and others.

SCRIBNER, NEB. — The Dodge County Farmers' Telephone Company will erect a central office here, at a cost of about $2,000. C.

VIKING, MINN.—The Viking Telephone Company will build a line through to Thief River Falls this spring. Work will soon be started.

BILOXI, MISS.—Cumberland Telephone & Telegraph Company contemplates the installation of a flashlight system. About $30,000 is to be expended.

LIVERMORE, CAL.—Cornell & Henry, lessees of Mendenhall Springs, are planning for a telephone line up the Arroyo Mocho as far as the springs.

McCLUSKEY, N. D.—The North Dakota Independent Telephone Company has purchased the McCluskey Exchange, and will make various improvements. C.

SEDGWICK, KANS.—The Sunflower Telephone Company has been incorporated with a capital stock of $2,000 by Theodore C. Coffman and Martin J. Brower.

PIERPONT, S. D.—The members of the Pierpont Telephone Company contemplate building a permanent home for the telephone. L. L. Nordness is secretary. C.

LUFKIN, TEX.—The city has granted a 30-year franchise for the construction of a new automatic telephone system. J. T. McClendon is one of the promoters.

SEATTLE, WASH.—Globe Telephone Company has been incorporated with a capital of $1,000,000. J. R. Wheat and George W. Temple are among the incorporators.

MAY, OKLA.—May Telephone Company has been incorporated with a capital stock of $2,500 by J. E. Feather, Joe Phillips and T. M. Fleming, all of May.

SAN JOSE, CAL.—The Valley Rural Telephone Company has been granted permission to establish pole lines along the country roads in the neighborhood of Valley View.

HOISINGTON, KANS.—The Hoisington Stickney Telephone Company has been incorporated with a capital stock of $1,000 by Frank Gage, A. H. Boyle and others.

CLAYTON, WIS.—The Clayton Rural Telephone Company has been incorporated with a capital stock of $5,000 by Gustafson Paulson, Ernie Muelhausen and Theodore Erickson.

EL DARA, ILL.—El Dara & New Canton Telephone Company has been incorporated with a capital stock of $602. The incorporators are H. A. Trautwein, O. E. Chase and J. R. Fesler.

NEW FRANKEN, WIS.—New Franken Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are: A. L. Grieling, W. A. Grieling and Emil A. Weber.

MORONI CITY, UTAH.—Moroni Telephone Company has been incorporated with a capital stock of $3,000. Edward Johnston is president, and E. D. Anderson, secretary, of the new company.

ST. ALBANS, VT.—The Franklin County Telephone Company is considering the installation of the common battery system in connection with the many other improvements which are in progress.

MERCED, CAL. — The Merquin Telephone and Electric Light Company has been incorporated with $25,000 capital stock. The directors are A. L. Bruce, David Larson, W. H. Joy and J. W. Bower.

PEAR VALLEY, TEX.—J. A. Carroll is president, and A. J. Ricks is secretary of a company which has been organized to construct a telephone exchange connecting with Brady, Coleman and other points.

FIGSBORO, VA.—The Mutual Telephone Company has been incorporated with a capital stock of $500. A. G. Reynolds, Vashti, is president; G. T. Bondurant, vice-president, and R. W. Pedigo, secretary-treasurer.

WAYCROSS, GA.—Southern Bell Telephone & Telegraph Company has been granted a 20-year extension of franchise and will install a common-battery multiple-switchboard system and erect a telephone exchange.

LITTLE SIOUX, IOWA.—The Sioux Valley Telephone Company has filed articles of incorporation with the Secretary of State with a capital stock of $225. The incorporators are A. M. Rolph, E. Stucker and J. W. South.

LITTLE ROCK, ARK.—The Arch Street Telephone Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are R. S. Parker, Dan Rauch, Louis Kriby, Edwin Watters, James Dorrough and others.

GARY, MINN.—The Gary Telephone Company will build a modern brick telephone exchange here this spring. The secretary will buy 600 cedar posts; 350 being 18-foot, 5-inch top; 200, 18-foot, 6-inch top and 50, 25-foot, 5-inch top. C.

SAN BERNARDINO, CAL.—The Interstate Telegraph Company has filed articles of incorporation with principal place of business at Carson City, Nev. The company, which is capitalized at $100,000, will complete lines in Nevada and California.

ZEELAND, MICH.—The Zutphen Farmers' Independent Telephone Company has been organized to build a line from Vriesland, Bernip Corners, Hudsonville to Zutphen and Jamestown. Jacob Nyenhuis is president, and A. H. Bosch, secretary, of the company.

STOCKTON, CAL.—The Stockton Telephone Company has been incorporated with a capital stock of $5,000 to operate a telephone line between Stockton and adjoining towns in Chautauqua county. The incorporators are Amos T. Carr, Mary S. Carr and Chamcey G. Warren, all of Stockton.

NEW LONDON, IND.—New London Co-operative Telephone Company has been incorporated with a capital stock of $3,000 to operate in Howard, Carroll and Clinton. The incorporators are E. A. Mendenhall, W. F. Newby, A. T. Cosand, J. D. Ryke, C. R. Nesbit, C. E. Hollingsworth and R. E. Newcom.

HOLTVILLE, CAL.—The Valley Telephone Company has filed articles of incorporation for the purpose of taking over the stock of the Eastern Telephone Company. The directors are: A. E. Wright, P. C. Curtis and O. N. Shaw. The company has capital stock of $25,000 and will build 150 miles of line reaching Calexico, Brauley, Imperial and El Centro.

ELECTRIC RAILWAYS

(Special Correspondence.)

FRESNO, CAL.—The Southern Pacific Company is planning to electrify its steam road from here to Friant.

ROUNDUP, MONT.—M. H. Wall, August Schrupp and others have been granted a franchise for an electric railway. C.

TORONTO, ONTARIO.—Plans for R. Home Smith's Humber Valley electric road have been approved by the Etobicoke Council.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company has been granted a franchise to extend its car line from Fort Smith to Van Buren.

CEDAR RAPIDS, IOWA.—The Cedar Rapids & Iowa City Railway & Light Company has been granted a 25-year franchise for a new interurban to Mount Vernon.

WICHITA, KANS.—As soon as good weather is here the Arkansas Valley Interurban Railway will make extensions south, north and east of Wichita.

SANTA CLARA, CAL.—The Peninsular Railway Company has been granted a 50-year franchise to operate a standard gauge electric railroad in this city.

RICHMOND, CAL.—The Southern Pacific Company has decided upon the eletrification of its lines between Berkeley and this city, and from San Leandro through Haywards to Niles.

HICKMAN, KY.—Kentucky Southwestern Electric Railway Company is going right ahead with plans for building the interurban road between Paducah and Hickman.

CARIBOU, ME.—Over $11,000 worth of stock has already been sold for the proposed electric line to run from Caribou to a point on the line running from Washburn to New Sweden.

GARRETTFORD, PA.—The Philadelphia & Garrettford Electric Street Railway Company has been authorized to construct a branch between Garrettford and Media.

QUEENS, N. Y.—The Brooklyn Rapid Transit Company proposes to build a street-car line from Queens to connect with the Brooklyn Lines and directly with Brighton Beach and Coney Island.

GARY, IND.—The Chicago City & Connecting Railways Company, represented by A. L. Drum, has announced that it will develop a gigantic traction system covering the entire steel belt from Gary to Joliet, Ill.

MAYS LANDING, N. J.—A new short-line electric road to be operated by the Pennsylvania Railroad is to be built from Mays Landing to Somer's Point. It is expected to have the line in service by July 1.

FORT WAYNE, IND.—Work on the new electric line between Defiance, O., and Fort Wayne is expected to be under way by April 1. K. B. Haymaker, Defiance, O., is said to be the promoter of the scheme.

BARTLESVILLE, OKLA. — J. J. Curl, president of the Bartlesville Interurban Railway Company, has announced that the line will be extended from Dewey, Okla., to Caney, Kans., a distance of about 15 miles, this spring.

MONMOUTH, ILL.—It is stated that New York and Washington capital is interested in the extension of the Rock Island Southern interurban into Burlington and that the extension will be made in the near future.

NEW SHARON, IOWA.—The right of way for the new high-power electric transmission line from Oskaloosa to New Sharon for the Oskaloosa & Buxton Electric Railway Company has been secured. C.

VANCOUVER, WASH.--The Washington Oregon Corporation has received a license from the War Department to build a single-track electric line through Vancouver Barracks. The proposed line will be built at once at an estimated cost of $50,000.

WATERLOO, IOWA.—The capital stock of the Waterloo, Cedar Falls & Northern Railway has been increased $50,000. The increase together with $50,000 that has been raised by La-Porte citizens, will be used for the construction of an extension to that place, a distance of 15 miles. C.

ROCKPORT, TEXAS.—The Rockport & Aransas Pass Interurban Railway Company will be granted a franchise for the use of streets of this place for the proposed interurban electric railway between Rockport and Aransas Pass, a distance of 10 miles. Charles T. Huff is president and general manager. D.

COLUMBUS, TEX.—H. B. Montgomery, a civil engineer from Dallas, has been surveying for a new interurban railway from Branham, through Industry, New Ulm and Columbus to a point on the Coast to connect with the Intercoastal Canal, now under construction. Power will be obtained from the Colorado River.

SPOKANE, WASH.—Contracts will be let by the Oregon & Southern Railway Company within thirty days for the first 63 of the 181 miles of road which this company plans to build in Oregon between Ashland, Roseburg and Marshfield. The contracts call for the completion of the first 63 miles by December 1.

GREENVILLE, TEX.—The East Texas Traction Company has been organized with a capital stock of $2,000,000. Its purpose is to construct an interurban electric railway between Dallas and Wolfe City *via* Greenville, a distance of about 80 miles. The incorporators are Joseph F. Nichols, W. A. Williams and J. W. Crotty. D.

SAN FRANCISCO, CAL. — The Geary Street Park & Ocean Railway Company has been notified that the construction work on that part of the Geary Street railway line yet to be laid must begin simultaneously with the tearing up of the old road bed, which must take place within 40 days. Provision has been made for the sale of $400,000 worth of Geary-Street railway bonds, bids to be received April 8.

FORT WORTH, TEXAS.—It is announced by George H. Clifford, vice-president and manager of the Northern Texas Traction Company, Fort Worth, that the recent increase of its capital stock from $4,500,000 to $6,000,000 is to provide for extensive improvements. Among these will be the enlargement of the power station at Handley, to consist of the installation of an additional 5,000-kilowatt turbine. It is also planned that between $50,000 and $100,000 will be spent in double tracking the line between Fort Worth and Handley. D.

NEW YORK, N. Y.—A company known as the New York & New Jersey Inter-Urban Company has been organized to build a trolley line in the upper part of New Jersey. The route as planned will include Fairlawn, Hawthorne, Prospect Park, Haledon, on to Sterling Forest. From there a viaduct will be built to Storms Island and continued across the lake to the Woodlands. It is stated that H. J. Biel, president of the United Cigar Stores, and Colonel H. R. Green, of the Child's Restaurant & Catering Company are among the promoters.

NEW INCORPORATIONS.

YONKERS, N. Y.—Yonkers Lighting Fixture Company has been incorporated with a capital stock of $2,500 by L. L. Fletcher, Charles W. Boote and Leslie Briant, all of Yonkers.

INDIANAPOLIS, IND.—The Gilson Electric Motor Starting Company has been incorporated to manufacture motor starters. Bert Gilson, R. K. and R. B. Allison are the incorporators.

TULSA, OKLA.—The Tulsa Electric & Construction Company has been incorporated with a capital stock of $6,000. The incorporators are F. A. Pierce, O. H. Kirkpatrick and E. L. Orr, all of Tulsa.

NEW YORK, N. Y.—Laco-Phillips Company has been incorporated with a capital stock of $300,000 to deal in electric bulbs, lamps, etc. The incorporators are Richard S. Aldrich, Joseph A. Bennett and Perley H. Noyes, all of New York City.

NEW YORK, N. Y.—Electric Fountain Company has been incorporated with a capital stock of $500 by Vincent S. Manson, Jacob Werner and Laura Battaglia, all of New York City. The company will manufacture electric novelties, etc.

ST. LOUIS, MO.—Independent Electrical Supply Company of Missouri has been incorporated with a capital stock of $10,000. The incorporators are Ralph A. Levene, Joseph Mayer, Felix Cornelius. The company will deal in electrical machinery and supplies.

BUFFALO, N. Y.—Swiss Magneto Company has been incorporated with a capital of $250,000 for the purpose of manufacturing magnetos, etc. The incorporators are Harry S. Martin, Dunkirk, N. Y.; A. A. Meggett, Chicago, Ill.; and Bradley H. Phillips, Buffalo, N. Y.

ANDERSON, IND. — The Central Heating Company has been incorporated with a capitalization of $130,000. The company has secured a franchise and will build and operate a public service heating plant. Ottis P. Crim, J. L. Vermillion and John W. Lovett are directors.

TERRE HAUTE, IND.—The Warren Engineering Company has incorporated to do a general business of constructing light, gas and water plants; also streets, roads and electric railroads. The capital stock is $25,000. W. P. Ijams, J. W. Ijams and G. E. Bowman are directors.

NEW YORK, N. Y.—American Voltite Company has been incorporated with a capital of $2,000,000 to manufacture and sell machines for plating metal, whether by electricity or otherwise, and to do a general electroplating business. The incorporators are Arthur E. Stilwell, Albert C. Dodge and Holmes C. Walton, all of New York City.

PROPOSALS.

ELECTRICAL APPARATUS. — Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until April 8 for furnishing electrical apparatus for Truckee-Carson project, Nevada. For particulars address the U. S. Reclamation Service, 603 Federal Building, Los Angeles, Cal., or Washington, D. C. F. H. Newell, director.

ELECTRIC CONDUITS AND WIRING, AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., for electric conduits and wiring and interior lighting fixtures until April 19 of a two-story building for the post office at Abbeville, S. C., until April 20 of a three-story building for the combined post office, courthouse and customhouse at Miami, Fla.; until April 22 of a one-story-and-basement building for the post office at Mexico, Mo.; until April 23 of a two-story building for the post office at Riverside, Cal.; until April 24 of a two-story building for the post office at Corinth, Miss. Copies of drawings and specifications may be obtained from the custodians of the various sites or from the office of the Supervising Architect.

LIGHT FIXTURES.—Sealed proposals will be received by the Treasury Department, Office of the Supervising Architect, Washington, D. C., until April 2 for furnishing and installing lighting fixtures in the United States buildings at Braddock, Pa.; Coffeyville, Kan.; Connellsville, Pa.; Dyersburg, Tenn.; Easton, Pa.; Fort Collins, Colo.; Gadsden, Ala.; Greenwood, Miss.; Lead, S. D.; Pana, Ill.; Sulphur Springs, Tex.; Terrell, Tex.; Warrensburg, Mo.; Wichita Falls, Tex.; Charleston, W. Va.; Phoenix, Ariz.; Sioux Falls, S. D.; Richford, Vt., and San Diego, Cal., in accordance with drawings and specification, copies of which may be obtained at the office of the Supervising Architect. Each proposal must be accompanied by a certified check in the sum of $500, drawn to the order of the treasurer of the United States, as a guarantee of good faith. Proposals should be addressed to the Supervising Architect, Treasury Department, Washington, D. C., and the envelope indorsed "Proposal for Lighting Fixtures, U. S. Buildings at Braddock, Pa., Etc."

FINANCIAL NOTES.

A review of market conditions for the past week indicates a continued advance in the face of persistent industrial and political unrest. Under normal speculative conditions the market ought to respond to the German and English coal strike and the strong probability of an American coal strike in the near future. Notwithstanding these untoward developments, however, values have steadily risen not only in the American market, but in the European market as well. Indeed there appears to be a remarkable unanimity of sentiment tending toward an actual and substantial improvement.

The Mexico Northwestern Transportation Company, Ltd., has been organized at Ottawa, Canada, by the Mackenzie & Mann syndicate with a capitalization of $25,000,000. Its charter authorizes it to build and operate railways, pipe lines, mills, grain elevators, hotels, amusement parks, steamships, piers, smelters and furnaces, power houses, to develop mines and waterpowers, etc. It also has authority to change the name of the company to Mexico Northwestern Pacific Railway Company.

The McCrum-Howell Company has been placed in the hands of Federal receivers on proceedings brought in Philadelphia and Chicago in the name of H. E. Pfahler, of Philadelphia.

The plan for reorganizing the United Wireless Telegraph Company has been agreed upon and the work of reorganization will be begun at once, according to a statement given out by Saul S. Myers, counsel for the reorganization committee of the stockholders. According to the statement, which is signed by Arthur P. West, chairman of the reorganization committee, shareholders having upward of 300,000 shares of stock have sent in their subscriptions and an equal number have written the committee that they would be glad to come into the reorganization if the time limit was extended to April 1. This has been done.

H. M. Byllesby & Company, of Chicago, are said to have completed an examination of the Toledo Railways & Light properties and are negotiating with the committees representing the bondholders and stockholders of the company, with a view to formulating a plan of reorganization which may result in acquisition by Byllesby & Company of such an interest in the company as will give it the benefit of their supervision.

The following securities have been listed on the New York Stock Exchange: New York Railways Company temporary bonds for thirty-year first real estate and refunding mortgage, four-per-cent bonds up to $16,768,000, temporary bonds for thirty-year adjustment mortgage, five-per-cent income bonds up to $31,933,000; $8,132,000 refunding mortgage four-per-cent bonds, $12,017,400 adjustment five-per-cent bonds and $8,897,000 capital stock of the Third Avenue Railway Company.

The General Electric Company reports a slight improvement in business since the first of January over the corresponding period in 1911. Plans are said to be under consideration for the declaration of a stock dividend which will probably bring the capitalization up from $77,208,700 to approximately $100,000,000. The company now has a working capital of about $66,000,000 and a surplus of $30,000,000.

A Western Union official says that the spring business is opening up earlier than usual, with volume fifteen per cent over last year. Southwestern business is especially good because of bright outlook for all spring crops. Present scarcity of competent telegraphers may develop famine with peak of summer's load. The development of automatic telephones and normal increase of manual operators is far behind the development of business.

The United Light & Railways Company will shortly sell an issue of bonds and additional stock to finance its purchase of new properties, notably the Tri-City Railway & Light Company, operating all public utilities of Davenport, Rock Island, Moline and some adjacent towns, and an interurban line under construction between Davenport and Muscatine. The United Light & Railways owns different public utilities in Chattanooga, Cedar Rapids, Muscatine, Fort Dodge, Mattoon, Laporte and Cadillac. It will also acquire the gas company of Ottumwa, Ia., and the Grand Rapids, Grand Haven & Muskegon Interurban Railroad. The following directors will be added to its board: Samuel Insull, J. G. White, Edward R. Russell, William Butterworth, J. F. Porter and E. G. Filer. Its officers will be Frank T. Hulswit, president; Richard Schaddelee and J. F. Porter, vice-presidents.

Dividends.

American Gas & Electric Company; a quarterly common dividend of 1.5 per cent, and preferred of 1.5 per cent, the former payable April 1, and the latter May 1.

Augusta-Aiken Railway & Electric Corporation; a dividend of 1.5 per cent on the preferred stock, payable March 30 to stock of record March 15.

Chattanooga Railway & Light Company; a quarterly dividend of 1.25 per cent, payable April 1 to stock of record March 15.

Niagara Falls Power Company; the regular quarterly dividend of $2, payable April 15 to stock of record April 1.

New York Edison Company; a quarterly dividend of 1.5 per cent, payable March 14.

Porto Rico Railways, Limited; a common dividend of one per cent, and a preferred dividend of 1.75 per cent, both payable April 1 to stock of record March 22.

Union Traction of Indiana; semi-annual preferred dividend of 2.5 per cent, payable April 1.

Washington Water Power Company; a quarterly dividend of two per cent, payable April 1 to stock of record March 15.

West End Street Railway Company; semi-annual common dividend of $1.75 per share, payable April 1 to stock of record March 22.

West India Electric Company, Limited; a quarterly dividend of 1.25 per cent, payable April 1.

Western Union Telegraph Company; a quarterly dividend of 0.75 per cent, payable April 15 to stock of record March 20.

Reports of Earnings.

EDISON COMPANY OF BOSTON.

The report of the Edison Electric Illuminating Company, of Boston, for the month of February and eight months ended February 29, compares as follows:

	1912	1911
February gross	$559,036	$515,933
Expenses	196,108	190,255
February net	362,928	325,678
Eight months' gross	3,924,695	3,550,646
Expenses	1,557,434	1,483,143
Eight months' net	2,367,261	2,067,503

WESTERN UNION TELEGRAPH COMPANY.

In its preliminary estimated statement of earnings for the quarter ending March 31, 1912, the Western Union Telegraph Company places the probable net revenue at $1,220,000, against $1,420,988, the actual figures for the corresponding period last year. Here are the estimated figures in comparison with the actual figures reported for 1911:

	1912	1911
Net revenue	*$1,220,000	$1,420,988
Bond interest	434,250	433,311
Balance	$785,750	$987,677
Dividends	747,970	747,846
Surplus	$37,780	$239,831

Profit and loss surplus as of March 31, 1912 (partially estimated), $12,329,414.

*After deducting quarterly assessment for repairs and depreciation pursuant to resolution of January 31, 1912, that there be appropriated for 1912 in equal quarterly installments out of earnings the sum of $3,400,000 for repairs and maintenance and $5,000,000 (in such quarterly installments as may be determined) for reconstruction and depreciation reserve.

The partly estimated earnings of the Western Union Telegraph Company for the nine months ended March 31, 1912 (actual to December 31, 1911), compare with the actual figures of the previous year as follows:

	1912	1911
Net revenue	$5,761,606	$5,122,863
Bond interest	1,302,740	1,299,436
Balance	$4,458,866	$3,823,427
Dividends	2,243,807	2,243,418
Surplus	$2,214,959	$1,580,009

Lewis Cass Ledyard has been elected a director of the company to fill a vacancy of long standing.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Mar. 18.	Mar. 11.
Allis-Chalmers common (New York)	¾	⅝
Allis-Chalmers preferred (New York)	5	4½
American Tel. & Tel. (New York)	147¼	146
General Electric (New York)	164½	163⅜
Kings County Electric (New York)	129	129
Postal Telegraph and Cables common (New York)	80½	81
Postal Telegraph and Cables preferred (New York)	69	69
Western Union (New York)	84¼	84⅜
Westinghouse common (New York)	74	73⅛
Westinghouse preferred (New York)	118	119
Edison Electric Illuminating (Boston)	298	288
Massachusetts Electric common (Boston)	21	21¼
Massachusetts Electric preferred (Boston)	96	96½
New England Telephone (Boston) (ex dividend)	160	162
Electric Company of America (Philadelphia)	11⅞	11⅞
Electric Storage Battery common (Philadelphia)	56	55
Electric Storage Battery preferred (Philadelphia)	56	55
Philadelphia Electric (Philadelphia)	18⅜	18⅞
Chicago Telephone reps. (Chicago)	144	144
Commonwealth Edison (Chicago)	147½	148
National Carbon common (Chicago)	105	103½
National Carbon preferred (Chicago)	116¼	115

PERSONAL MENTION.

E. C. RIDDLE, for the past three years superintendent of the Ohio Traction Lines, St. Mary's, O., has tendered his resignation.

FRANK A. BROOKS, formerly Illinois representative for the Wesco Supply Company, has been appointed manager of the Lighting Supply Department of the home office at St. Louis, Mo.

N. E. DORSEY, associate physicist in the United States Bureau of Standards, has been appointed research associate in the department of terrestrial magnetism of the Carnegie Institution of Washington.

HARRY KUNDE, formerly city salesman of the Doubleday Hill Electric Company, of Pittsburgh, Pa., is now district manager of the Peerless Electric Lamp Company with headquarters in the Jenkins Arcade Building, Pittsburgh.

FRANK D. CHASE, architect of the Western Electric Company, has opened offices in the People's Gas Building, Chicago, Ill., for the practice of architecture and industrial engineering, making a specialty of manufacturing plants and mercantile buildings.

H. J. PETTENGILL, until recently president of the Southwestern Telephone & Telegraph Company, Dallas, Tex., has assumed the duties of his new office as president of the Bell Telephone Company of Missouri, with headquarters at St. Louis.

CHARLES T. JAEGER, of the Jaeger Miniature Lamp Company, announces his retirement from the firm he founded 15 years ago, and built up to the present high standing. While Mr. Jaeger may continue to act in an advisory capacity, his efforts will be devoted to research work and developing the industry from a manufacturing standpoint.

RAY PALMER has been appointed city electrician of Chicago. Mr. Palmer is a graduate of the University of Wisconsin. He has been engaged in consulting engineering work in Chicago about three years. His investigation of electrolysis conditions in Milwaukee attracted the attention of the municipal authorities of Chicago and last summer he made an extended investigation of similar conditions in Chicago and recommended many changes to mitigate the trouble.

WILLIAM CARROLL has retired from the position of city electrician of Chicago, which he has held about seven years, through more than two administrations. He thus closes a continuous service in the city's electrical work of nearly 38 years. He became a battery attendant in the fire-alarm telegraph division in 1874 and had risen steadily through all the positions in the city's increasing electrical activities until he became the head of the department of electricity in 1905, when his predecessor, E. B. Ellicott, became electrical engineer of the Sanitary District of Chicago.

OBITUARY.

RALPH E. ALLEN, manager of the Bell Telephone Company, Bowling Green, O., died recently in Toledo. Mr. Allen is survived by his wife and little son.

HENRY HARRISON MATLOCK died at Springfield, Ill., March 6 at the age of 71. Mr. Matlock was a member of the telegraph corps of the private staff of Secretary of War Stanton.

GEORGE W. MELVILLE, rear-admiral, United States Navy, retired, died on March 17 at his residence in Philadelphia, Pa. He was 71 years of age. His work in steam engineering was well known, and he was joint inventor of the reduction gear for using steam turbines on ships. He was a past president of the American Society of Mechanical Engineers.

WILSON SHANNON CHAPMAN, a member of the Telephone Pioneers of America, died suddenly on February 5 at his home in Chicago, Ill., in the seventieth year of his age. He became associated with Colonel Clowry in the United States Military Corps, and later entered the service of the Western Union Telegraph Company. He was secretary and treasurer of the Central Union Telephone Company for 32 years, retiring in 1911.

CHARLES THOMPSON HARVEY, a member of the Royal Engineering Society of London, died after a brief illness March 11 at the Hotel Calumet, New York City, where he resided. Mr. Harvey was born in Westchester, Conn., 83 years ago and was the builder of the first elevated railroad on Ninth Avenue. On the day of his death Mr. Harvey was to have gone before the Public Service Commission to submit patent devices for the new elevated lines to be constructed. He is survived by his wife and two sons.

HENRY W. SPANGLER, professor of dynamical engineering in the University of Pennsylvania, died on March 18, after an illness of several months. Professor Spangler was born at Carlisle, Pa., January 18, 1858, and was graduated from the Naval Academy in 1878. He received the honorary degrees of Master of Science and Doctor of Science. He served in the Navy until 1889, when he became professor at the University of Pennsylvania, and instituted the course in electrical engineering at that institution. His books on thermodynamics and valve gears are well known.

OSBORNE REYNOLDS, late professor of engineering at Manchester University, England, died on February 21. Professor Reynolds was widely known for his versatility and originality and made many contributions to the scientific and technical press, the importance of many of which was not at first recognized. His greatest work was a memoir on "The Sub-Mechanics of the Universe" presented to the Royal Society in 1902. His theories of matter and of gravitation are celebrated. Professor Reynolds was born in Belfast in 1842 and was appointed to a chair in Owens College in 1868. He retired from active work six years ago on account of poor health.

D. D. DICKEY, general manager of the National Carbon Company, Cleveland, O., died on March 8 as the result of an operation for an internal trouble. Mr. Dickey was born at Pittsburgh, Pa., October 9, 1853, and in his early life he attended the Western University of Pennsylvania. At the time of his death, he was a patriarch in the carbon-manufacturing business of the United States. In 1883 he acquired an interest in the Pittsburgh Carbon Company, and a few years later the plant was moved to Jeannette, Pa., and the name changed to Faraday Carbon Company. Mr. Dickey had a controlling interest in this company until the consolidation of several companies into the National Carbon Company of New Jersey, in 1899, when he became a director and general manager of the consolidated companies. He went to Cleveland in January, 1899, and had since assisted in his quiet, strong way in the advancement of many of the city's interests. He was a member of the Union, Country, Roadside and Rowfant Clubs, and of the Cleveland Chamber of Commerce and the Chamber of Industry. His death was a great shock to all, and everyone who knew him feels a personal loss.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Manufactures, Washington, D. C., and refer to the file number noted.)

No. 8241. ELECTRIC POWER MACHINERY.—Several individuals and concerns in different parts of Mexico are planning to generate electricity with water power. This will be employed generally for irrigation purposes, taking water out of mines, lighting cities, towns, or plantations, running grinding mills, factories, and all kinds of farm and other machinery. In all cases there will be a demand for electric power-generating machinery.

No. 8310. ELECTRIC RAILWAY.—An American consul on an island in the Atlantic Ocean has forwarded a report on the opportunity for the construction and successful operation of an electric railway in his district. Accompanying the report were maps, photographs, etc., all of which can be secured by interested capitalists and contractors.

No. 8313. ELECTRIC GENERATING POWER MACHINERY.—A report from an American consular officer in Mexico states that English capital is interested in the erection of several electrical power plants at different points in the country. The electricity will be generated by water power. American manufacturers and exporters of the machinery required should communicate with a representative of the persons interested.

No. 8314. TELEPHONE OUTFIT.—The Government of a Latin-American country has granted a concession for an underground telephone system in a certain city, with the privilege of erecting rural lines to other points in the country. American manufacturers should communicate at once with the person in charge of the matter whose name and address are on file in the Bureau of Manufactures.

No. 8326. TELEPHONE EQUIPMENT.—A telephone company which has been operating in a Latin-American city for several years with overhead wires is making arrangements to install an underground system.

No. 8356. STEEL PIPE, ELECTRIC METERS, AND LIGHTING SUPPLIES.—The American consular agent at Nelson, British Columbia, Canada, reports that the Nelson city council has decided to install electric meters throughout the city and will require about 400 this year, and an equal number for the two succeeding years. The question of lighting is under consideration, and the council will probably be in the market for a quantity of cast-iron columns for cluster lights to install on the main streets. Detailed information concerning all of these propositions can be obtained from the City Clerk, Nelson.

With the Electrical Manufacturers

The Doubleday-Hill Electric Company, of Pittsburgh, Pa., has moved from its old location and now occupies the entire ten-story building at 711-713 Liberty Street. The new quarters have over 35,000 square feet of available floor space and will permit of the contemplated expansion of the firm's business.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has supplied its newly developed drum-type crane controllers for 17 electric cranes in the new plant of the Union Steel Castings Company, Pittsburgh, Pa. This is the first large installation of these controllers and is proving satisfactory in every way.

The SKF Ball Bearing Company, 50 Church Street, New York, N. Y., has issued a 16-page catalog of SKF single and double-thrust ball bearings. The dimensions and physical properties of these bearings are fully set forth. The self-alining feature of these bearings is strongly advocated. The bearings are also made without this, however.

The Appleton Electric Company, Chicago, Ill., is distributing its new 84-page catalog. This is complete and covers in detail all the material manufactured by the company, which makes a specialty of sherardizing its fittings. Many new features in the line of Unilets, which should be of interest to engineers and electrical contractors throughout the country, are shown.

Mathias Klein & Sons, 562-564 West Van Buren Street, Chicago, Ill., has issued a very interesting Pocket Tool Guide for wiremen, linemen and electricians. This company has been engaged in manufacturing for more than half a century, and Klein tools have been standard for over thirty years. There does not appear to be anything that the mechanic in the electrical business might need that is not listed in this catalog. Copies will be sent to those interested upon request.

Ashley & Kaufman, consulting engineers, have removed their offices to 417 Fifth Avenue, New York City. Special work undertaken by this firm is the design of heating, lighting, ventilating, refrigerating and sanitary installations. Among the work now on hand at the new office is the complete engineering of new high school buildings at Albany and Mt. Vernon, large hotels at Pittsburgh and Jacksonville, the Second National Bank at New Haven, besides four large office and store buildings in New York City.

The Western Electric Company has published an attractive little book named "The Silent Partners—A True Story." This booklet, written in an easy, colloquial style, is so convincing that the reader wants to invest in everything described therein. The advantages of Western Electric Interphones as time and step savers; of desk, bracket, ceiling and counter fans as creators of coolness; of ventilating or exhaust fans as fresh-air producers; and of large and small motors for shop and factory use, are set forth cleverly.

Koerting & Mathiesen Company, New York, N. Y., sole manufacturers of Excello flaming arc lamps and Excello carbons, will continue its western headquarters at 631 West Jackson Boulevard, Chicago. The office details will be in charge of T. W. Hall, who has been associated with George W. Armstrong, general manager of the company for the past three years. H. Caird will act as sales engineer. Mr. Caird has had a wide experience in the

H. Caird.

electrical business, and has taken a leading part in the introducton of flaming arc lamps in this country. Mr. Caird became connected with the Excello Arc Lamp Company March 1, 1910, as manager of the engineering department. In June, 1911, he assumed duties at the main office in New York, resigning February 15 of this year to take a position as sales engineer of the western office of the new company.

The Virden Manufacturing Company, 6011 Longfellow Avenue, Cleveland, Ohio, has published a new catalog of V. M. C. Brass. This product consists chiefly of practically all conceivable parts of lighting fixtures that can be made out of sheet brass. Sheet copper and aluminum parts are also made. These are all made accurately to gauge and are capable of high finish. The company supplies them either unfinished or with brush brass or other finishes, as desired. The new factory that the company has built permits it to turn out this work on a large scale under the best conditions possible.

The Minerallac Electric Company, Merchants Loan & Trust Building, Chicago, Ill., has ready for distribution some interesting information respecting Minerallac insulating material and high-tension compounds. These bulletins give practical and technical information respecting the properties of these insulating materials, laboratory and operating tests, the use of the material in terminals and potheads, and a practical treatise on methods of making and insulating joints, impregnating transformers, and other applications. Copies of these bulletins will be furnished upon request.

The General Bakelite Company, 100 William Street, New York City, has published an interesting 42-page pamphlet giving the second compilation of authentic information about Bakelite. This valuable synthetic product is described in its three forms, A, B and C. Among its manifold applications described are Bakelite varnishes and lacquers, protective enamel, impregnated wood, adhesive cement, molding composition and molded articles, electrical uses such as for insulators, brush holders, insulating bushings, outlet and switch boxes, coil impregnation, etc. A variety of objects molded out of Bakelite are illustrated, also a Bakelizer for baking the molded articles under pressure.

Gardiner Paint Company, New York, N. Y., has appointed Manfred A. Pakas, formerly with the Flour City Ornamental Iron Works, western agent for Gardiner's anti-rust paint. Mr. Pakas will make his headquarters in the Plymouth Building, Minneapolis, Minn. This paint has been used by the United States Government on all its battleships for the last 20 years. The paint is also being used in the Hotel Alpin, now in course of construction in New York City, which will be the largest hotel in the world when completed. Various eastern steam and electric railroads have also adopted this paint, as it is an electrical insulator and affords protection from electrolysis. A special feature of the paint is that it is not affected by acids or alkali. Robert W. Hunt & Company, the well known engineers, have made a test of the paint and submitted a most favorable report.

The General Electric Company, Schenectady, N. Y., has issued a number of important new publications. "The Application of Electricity to Marine Service" is the title of bulletin 4926; this publication is printed in colors, describes the great variety of electrical apparatus and supplies manufactured by the company for marine service, and contains data of general interest to motor-boat owners. Among these data will be found reproductions in colors of the flags of the principal yacht clubs throughout the country, and of weather and storm signals. Bulletin 4927 describes the manufacture of feeder-voltage regulators. It illustrates the various processes in their construction and shows the facilities possessed by the company at its Pittsfield works for the manufacture of this type of apparatus. This bulletin will be found of great interest to electrical men gener-

ally. Bulletin 4930 is devoted to the application of electric drive to ice and refrigerating plants, and illustrates the advantages offered by this method of drive as compared with steam power. The bulletin contains illustrations of various installations of electric motors in connection with this industry.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a special publication (No. R. L. 57) entitled "Synchronous Motors for Power-Factor Correction." This is a 26-page pamphlet containing a reprint from the *Electric Journal* of an article on this subject by Nicholas Stahl; it also gives illustrated descriptions of several installations of this character. This publication gives much valuable and sensible data on the bad effects of low power-factor and how these may be overcome by the proper use of synchronous motors. Curves and diagrams are given whereby one can determine with a few simple calculations, the capacity of a synchronous motor necessary to correct a given load from and to given power-factors. Directions and diagrams are given for solving by inspection the other problems that arise in connection with power-factor phenomena. The features of the booklet that will be appreciated by practical engineers are the simplicity of the treatment and the many examples illustrating the use of the data and curves. This pamphlet should be in the hands of every man that has to do with alternating-current power circuits.

DATES AHEAD.

American Institute of Electrical Engineers. Pacific Coast meeting, Portland, Ore., April 16-20.

American Electrochemical Society. Twenty-first general meeting, Boston, Mass., April 18-20.

Iowa Electrical Association. Annual meeting, Des Moines, April 24-25.

Iowa Street and Interurban Railway Association. Annual meeting, Des Moines, April 25-26.

Association of Iron and Steel Electrical Engineers—American Institute of Electrical Engineers. Joint meeting, Pittsburgh, Pa., April 25-27.

Southwestern Electrical and Gas Association, San Antonio, Tex., April 25-27.

American Institute of Electrical Engineers. Schenectady, N. Y., May 17.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

Mississippi Electric Association. Fourth annual convention, Vicksburg, Miss., May 28-30.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Michigan Section of the National Electric Light Association. Annual convention on board the *Majestic* sailing from Port Huron, Mich., about June 21.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 16-19.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26.

American Electric Railway Association. Annual convention, Chicago, Ill., October 7-11.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

Record of Electrical Patents.

Issued by the United States Patent Office, March 12, 1912.

1,019,748. Miner's Lamp. H. Becker, Baltimore, Md. An incandescent lamp is mounted on the vizor of the miner's cap and connected to a battery carried on his body.

1,019,757. Controller for Electric Motors. V. E. Chamberlin, assignor to Waverley Co., Indianapolis, Ind. A vehicle controller with an interlock between the control and reverse levers.

1,019,759. Magnetic Skelp-Charging Machine. S. C. Coey, Youngstown, O. A rotary electromagnet picks up the skelp and conveys it into the furnace.

1,019,763. Electromagnetic Time Recorder. C. H. Crafton, Staunton, Va. Has a revolving and recording disk with circuit-closing fingers.

1,019,764. Trolley - Wire - Supporting Device. G. W. Cravens, assignor to Electric Service Supplies Co., Philadelphia, Pa. Consists of a pair of clamping members, one fitting within the other and both fulcrumed on each other so as to grip the wire when the stud joining them is screwed up.

1,019,774. Trolley Retainer. A. H. Fletcher, New York, N. Y. The head of the pole has two opposite parts, the one carrying the wheel being hinged.

1,019,781. Signaling System. E. R. Gill, assignor to H. E. Merrell, New York, N. Y., and O. J. Hamlin, Smethport, Pa. Permits the simultaneous operation of telephones and signal devices.

1,019,792. Capping-Off Device. H. F. Hitner, assignor to Pittsburgh Plate Glass Co., Pittsburgh, Pa. Glass cylinders are cut off by placing a resistance wire around them and passing an electric current through it.

1,019,795. Rural - Mail - Delivery Device. A. Jenson, assignor to Kenyon Electrical Manufacturing Co., Kenyon, Minn. A small electric mail car runs as a trolley suspended from a pair of cables.

1,019,821. Hickey. J. Miller, assignor to Western Gas Fixture Co. Has an external thread at one end to receive the fixture up to a shoulder and a wire-receiving slot terminating beyond the shoulder.

1,019,835. Tool for Removing Insulation from Wires. H. Prack, Ottawa, Ill. Each of the plier jaws has extended parallel side bars with a cutting bar between them, each set being supported by end plates with a transverse inner cutting edge.

1,019,848. Trolley. P. J. Schnoor, Holstein, Ia. The trolley harp is pivoted for lateral movement.

1,019,879. Telephone Metering System. G. Babcock, assignor to Telechronometer Co., Rochester, N. Y. Includes a clock to measure the duration of toll connections, means for registering the charge at an appropriate rate and means for notifying the calling party of the amount of the charge.

1,019,883. Telegraph Transmitter. J. A. Cox and J. H. Kidwell, Parkersburg, W. Va.; said Cox assignor to said Kidwell. Co-operating contact-bearing springs are slidably mounted upon the key.

1,019,886. Ignition Timer and Detector. T. C. Forbes, assignor to Los Angeles Rotary Gas Engine Co., Los Angeles, Cal. Has a blade moved into contact with a plunger by a set of detector pins.

1,019,895. Head Lamp. H. M. Hays and W. R. Rosenbaum, assignors to Frank S. Betz Co., Hammond, Ind. Consists of a flat battery case mounted against the wearer's forehead and an incandescent lamp connected to the case by a universally adjustable joint.

1,019,901. Apparatus for Producing the Arc Light. I. Ladoff, Cleveland, O. assignor of three-tenths to P. C. Peck. The upper electrode is of coherent metal containing titanic material; the lower electrode is of powdered iron with titanic constituents and held in a metal shell.

1,019,902. Electrical Conductor for Lighting Purposes. I. Ladoff, assignor to W. D. Edmonds, Boonville, N. Y.; P. C. Peck, New York, and A. M. Ladoff. An arc-light electrode containing at least 15 per cent of silica mixed with iron and characterized as producing a flaming arc.

1,019,916. Process for Making Radiators. J. Porzel, Buffalo, N. Y. A matrix is cast in a mold, then removed and the radiator shell electrolytically deposited thereon.

1,019,969. Electrolysis of Metallic Solutions. F. Lacroix, Paris, France. Includes a rotating cathode and a stationary concentric anode.

1,019,970. Electrical Conductor for Lighting Purposes. I. Ladoff, assignor to W. D. Edmonds, Boonville, N. Y.; P. C. Peck, New York, N. Y., and A. M. Ladoff. An arc-light electrode containing metallic iron and a titanium compound.

1,019,992. Telephone System. J. L. Rue and C. F. Brown, Coshocton, O. Relates to details of the cord circuit with its relays and signals.

1,020,001. Electric Water Purifier and Filter. A. H. Van Pelt, Los Angeles, Cal. Has a filtering chamber below a pair of electrodes.

1,020,006. Spark Plug. G. Wright, assignor to H. J. Wright, Auburn, N. Y. Has a chamber to direct the combustible mixture to the electrodes.

1,020,016. Electric Delivery System. J. Bailey, Great Falls, Mont. Includes a switch biased to closing position. Movement of the electric motor opens the switch.

1,020,025. Distribution of Electromotive Power. H. Chitty, Kenley; M. T. Lange, London, and G. W. Mascord, Baries, Eng. Consists of an engine-driven self-excited generator supply-

ing current to a reversible motor and an auxiliary exciter for the motor and for temporarily reversing the generator field.

1,020,030. Toy. G. S. Elliott, San Marcial, N. Mex. A pendulum is kept in vibration by an electromagnet.

1,020,032. Signaling by Electromagnetic Waves. R. A. Fessenden, assignor to National Electric Signaling Co., Pittsburgh, Pa. An antenna is formed of wires placed horizontally in proximity to the ground, combined with a horizontally arranged reflector.

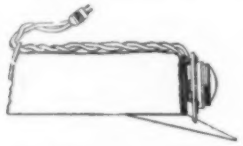
1,020,035. Lining Fastening for Electrical Lamp Sockets. E. H. Freeman, Trenton, N. J. The insulating lining is secured to the cap by prongs penetrating the fibrous material.

1,020,036. Insulating Lining for Electrical Lamp Sockets. E. H. Freeman, Trenton, N. J. The lining is molded in the cap over the prongs.

1,020,056. Composite Sheet-Metal Work. A. F. Rietzel, assignor to Thomson Electric Welding Co., Lynn, Mass. Two parallel plates with a space between them are electrically welded together at a number of points, forming double projections.

1,020,062. Electric Lamp Bracket. C. Strand, Gary, Minn. A pole bracket for incandescent street lamps.

1,020,063. Process of Electrostatic Separation. H. M. Sutton, W. L. Steele and E. G. Steele, Dallas, Tex. Com-



1,019,748.—Miner's Electric Lamp.

minuted material is fed on a moving belt that is charged electrostatically to a varying degree in different parts.

1,020,074. Fire Alarm. T. Bell, Fall River, Mass., and E. Brophy, Tiverton, R. I. Expansion of a mercury column moves a floating lever to strike a gong and close an electric alarm circuit.

1,020,080. Control Mechanism for Electric Vehicles. C. E. Cochran, assignor to Anderson Electric Car Co., Detroit. Has a common actuating device for the circuit-closing, speed-controlling and reversing switches.

1,020,109. Electrically Operated Vacuum Tube. D. McF. Moore, assignor to Moore Electrical Co., New York, N. Y. Contains a solid aromatic hydrocarbon disposed to be decomposed by the current.

1,020,110. Terminal for Gas and Vapor Electric Apparatus. D. McF. Moore, assignor to Moore Electrical Co. The forward edge of the electrode is shielded from the direct action of the electric discharge.

1,020,122. Electrical Insulator. A. C. E. Bolton, administratrix of D. G. Bolton, deceased, assignor to F. S. Diener, Camden, N. J. Includes a bushing of insulating material, a wire attached to the bushing, and means to seal the wire adjacent to the bushing.

1,020,123. Conduit Fitting for Electrical and Other Purposes. A. Brampton, Birmingham, and F. Osborne, Four Oaks, Eng. Consists of two half-round sheet-metal parts placed together to form a tubular fitting.

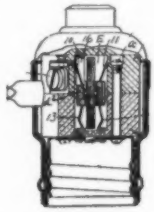
1,020,143. Magnet Frame for Electric Ignition Machines. G. Honold, assignor to Robert Bosch, Stutgart, Germany. Relates to the method of mounting the permanent magnets of a magneto.

1,020,149. Electrolytic Separator and Process for Making the Same. P. Marino, London, Eng. Consists of fibrous material having coatings thereon of silica, gutta percha and paraffine wax.

1,020,155. Electric Automusical Instrument. T. E. R. Phillips, Liverpool, Eng. Includes electromagnetically operated keys, several batteries of different voltage, corresponding busbars and an electric motor for operating the music rolls and sheets.

1,020,172. Trolley Head. H. J. Woolsey, Jackson, Mich., assignor of one-half to G. E. Schuberg. Has a vertical pivot to permit horizontal adjustment of the wheel.

1,020,185. Controlling System for Automatic Switching Apparatus. A. M. Bullard, deceased (by M. R. Bullard, administratrix) and J. N. Reynolds, assignors to Western Electric Co. An automatic telephone system in which a sequence switch on each individual selector controls a finder device to associate a master driving mechanism with any selector.



1,020,245.—Lamp-Socket Switch.

1,020,193. Reversing Mechanism. T. J. Dalton, Chicago, Ill., assignor of one-half to H. F. Lundin. An electric reversing switch has two bell-crank levers connected by a cord.

1,020,211. Automatic Telephone Exchange. G. W. Lorimer, assignor to Western Electric Co. Includes an automatic call-answering device governing an electromagnetic clutch for the line-contact brush.

1,020,231. Electric Snap Switch. W. V. P. Steiger, assignor to Bryant Electric Co., Bridgeport, Conn. Has an oscillating switch lever and an operating spindle capable of continuous rotation in either direction.

1,020,245. Electric Lamp Socket. W. Abbe, Brooklyn, N. Y. Has a snap switch with an insulating disk carrying a transverse conductor and capable of rotation in either direction.

1,020,249. Safety Fuse. I. E. Barricklow, Antioch, Cal. An inclosed cartridge fuse with a plug forced outward when the fuse melts.

1,020,262. Electroplating Apparatus. T. R. Canning, Birmingham, Eng. Has a rotatable inclined spindle carrying a detachable receptacle at its lower end.

1,020,289. Thermostat for Electric Heat-Regulating Systems. J. C. Kersteter, assignor to Electric Heat Regulator Co., Minneapolis, Minn. The adjusting mechanism is controlled by a timer.

1,020,319. Incandescent Electric Lamp. R. H. Singley, Burnham, Pa. A metallic-filament lamp with the filament supported between arms carried by two metal rings.

1,020,323. Electric Lighting. C. P. Steinmetz, assignor to General Electric Co. A mercury-vapor lamp with three electrodes has a capacity shunted across two of the electrodes and an inductance across from the middle to the third electrode.

1,020,330. Device for Preventing Collisions at Sea. D. H. Taylor, Palisades, Colo. A flexible conduit is driven some distance in front of the ship and is connected to the latter by electric alarm-circuit wires.

1,020,341. Electrically Operated Animal Trap. R. L. Barnhart, Charleroi, Pa. Includes a pair of trap doors between which an electric circuit is closed by the body of the animal.

1,020,378. Drum Heater. C. B. Wanamaker, assignor to Leedy Manufacturing Co., Indianapolis, Ind. Carries an electric heating element attached to a fitting plate.

1,020,378.—Electric Drum Heater.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 19, 1912.

535,810. Spring-Winding Means for Printing-Telegraph Instruments. J. Burry, Long Island City, N. Y.

535,838. Incandescent Electric Lamp. W. S. Lowe, Lima, O.

535,840, 535,841 and 535,842. Electric Arc Lamp. G. R. MacIntyre, New York, N. Y.

535,865. Electric Sign-Changing Device. W. Sears, Boston, Mass.

535,905. Method of and Apparatus for Obtunding Nerves. W. P. Horton, Jr., and A. B. Jones, Cleveland, O.

535,933. Street Sign for Electric Lights. R. S. Wright and H. C. Bradford, Somerville, Mass.

535,936. Conduit Electric Railway. F. P. Bergh and C. W. Tarbox, New York, N. Y.

535,948. Electric Program Clock. F. Frick, Waynesborough, Pa.

535,993. Closed-Conduit Electric Railway. J. F. McLaughlin, Philadelphia, Pa.

536,031. Cord Adjuster for Electric Lights. M. B. Hood, Montclair, N. J.

536,032. Alternating-Current Motor. M. Hutin and M. LeBlanc, Paris, France.

536,033. Railroad Signal. J. R. Jones, Philadelphia, Pa.

536,055. Apparatus for Automatically Limiting Speed of Electric Cars. L. S. Wright, Philadelphia, Pa.

536,076. Collapsible Conduit for Electric Railway Conductors. H. C. Grant, New York, N. Y.

536,095. Protective Device for Electrical Appliances. J. J. O'Connell, Chicago, Ill.

536,100. Automatic Toll Box for Telephones. H. C. Root, Brooklyn, N. Y.

536,104. Electromagnetic Signal. T. Spencer, Cambridge, Mass.

536,153. Tip for Flexible Electric Conductors. C. H. McEvoy, Lowell, Mass.